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The contractors for the Baltimore Belt Line tunnel, Messrs. Ryan & McDonald, have entered suit against the Maryland Construction Company for $900,000 claimed as a balance due them for extra work, etc. The company admits changes in plan, in providing quadruple instead of double track approaches, etc., but says that under the contract all extra work was to be paid for at prices fixed by the Chief Engineer, or at those specified in the original contract. Under these conditions the Chief Engineer has added $781,999.10 to the original contract price of $1,749,600, and $2,531,599.10 has been paid to the contractor. There still remains due, by the Chief Engineer's figures, the sum of $133,504.94, and this will be paid over as soon as the contractors settle the claims for damages to buildings along the line. Herein, apparently, lies the whole difficulty; by the terms of the contract the contractors were held responsible for these damages, which amount to more than the retained sum; but the contractors hold that the construction company, in part at least, is responsible, as changes in plan and reputed conditions effected these damages. The suit promises to be an interesting one.

The fourth call within some three years for bids on a new water supply for Jersey City brought in proposals on July 1 from three companies, two of which also put in bids a few weeks ago. The old bidders are the East Jersey and the Jersey City Water Cos., and the new one is the Rockaway & Hudson Water Co. All the formal bids were for a gravity supply delivered at high service, 210 ft. above tide. The works must have a daily capacity of 50,000,000 gallons, and the bids were based on varying quantities of water through single and double pipe lines, the companies to own the works, and on the price at which the city might buy the works. The prices given below are for single pipe lines only. The East Jersey Water Co. offered water for $64.50 to $33 per million gallons for quantities ranging from 20,000,000 to 50,000,000 gallons, and to sell the works for $9,000,000. The Jersey City Water Co. would furnish water at from $39.75 to $25 per million gallons and sell the works for $7,950,000. The prices offered by the Rockaway & Hudson Water Co. ranged from $57 to $25 per million gallons, or the city might buy the works for $5,650,000. The specifications allowed all formal bidders to put in informal propositions, and under this clause the East Jersey Co. made five bids, and the other two companies one each. Further details will be given next week.

Plans and estimates are being made for the extension of the Cleveland water intake tunnels to a point some four miles from shore. It is proposed to do this by means of a single 9-ft. tunnel. Water is now drawn through two tunnels from an intake crib located 6,000 ft. from the shore, the tunnels being somewhat longer than this. The older of the two tunnels was 5 and the newer one 7 ft. in diameter, the latter having been completed in 1891. Each of the old tunnels extends to the pumping station, 2,580 ft. from the shore, the land section of the first being 5½ and 6 ft. in diameter.

Bids for a new water intake tunnel at Chicago will soon be received, if it is true as reported that the city council has instructed the commissioner of public works to advertise for proposals for such work. The tunnel, according to reports, will extend about four miles from the shore into the lake, and also across the city to a pumping station at West 44th St. and Garfield Boulevard. A tunnel in the northwestern section of the city is also proposed. Mr. Samuel G. Artingstall is the city engineer.

The throttling of water mains in the lower portions of New York city in order to increase the pressure and supply in some of the more elevated portions of the city was the subject of extended discussion in the New York newspapers last week. While the necessity for throttling mains is to be deplored, the expedient is common enough throughout the country whenever a city develops at a more rapid pace than its water distributing system, or is suffering from a scarcity of water. In the present case it is alleged that no record has been kept of the lowered gates, and that many have been left entirely closed after making repairs through mere negligence, the water reaching the streets thus affected by some roundabout way.

The aeration of the water of a large storage reservoir by means of compressed air, to be furnished from an air compressor on a small steamboat to be placed on the reservoir, is reported as proposed by the Butte City Water-Works Co., of Butte, Mont. The work will be carried on only during the hot weather. It is evidently intended to prevent the development of unpleasant odors or tastes in the water due to stagnation and the growth of large numbers of minute organisms in the water.

Work has been resumed on the Pacific Short Line bridge over the Missouri River at Sioux City, Ia., after being at a standstill for over two years. The bridge was commenced in 1890, but work was stopped the same year and again in 1891, and was not then resumed until December, 1892. Through financial transactions consequent upon the failure of the Union Loan & Trust Co., the bridge was acquired by the Credits Commutation Co., and in June, 1895, that company voted to complete the bridge under a separate organization, Sioux City having voted about $320,000 (by a 2% tax) towards the work on condition that the bridge should be completed by March, 1896. The structure will carry a single railway track and two sidewalks between the trusses, and two roadways on cantilever brackets outside the trusses. There will be two draw-spans of 470 ft., and two fixed spans of 500 ft. each. The trusses will be spaced 25 ft. c. to c., and rest on masonry piers. The approaches will be short timber trestles and earth banks. About half of the ironwork has been rolled, two channel piers have been sunk to depths of 45 and 60 ft., one pivot pier and one draw-rest pier on the Iowa side have been sunk to bedrock, and the metal is on hand and partly riveted up for the other channel pier and the other pivot pier on the Nebraska side. The work done has involved the expenditure of about $500,000. The new company is styled the Combination Bridge Co.; President, John Ellis, of Kewanee, Ill.; Vice-President, Joseph C. Head, of Latrobe, Pa.; Secretary, F. L. Eaton, of Sioux City, Ia. Mr. J. A. L. Waddell, M. Am. Soc. C. E., is Chief Engineer, and Mr. Lee Treadwell, Assoc. M. Am. Soc. C. E., is in charge of construction. The contract for the substructure has been awarded to Sooysmith & Co., of New York, and that for the superstructure to the Phoenix Bridge Co., of Phoenixville, Pa. Work will be pushed vigorously, so as to have the bridge ready for traffic by March, 1896.

The most serious railway accident of the week was the derailment of a passenger train, June 20, at Fuller, Tenn., on the Southern Ry. Train wreckers had placed an obstruction against the inside of the rail, causing the engine to jump the track. The engineman was killed.——A passenger train on the Interoceanic Ry., Mexico, jumped the track near Jalapa, June 15, and several cars were wrecked. Three persons are reported killed and about 16 injured.

The propeller shaft of the steamer "Dania," of the Hamburg-American Line, broke on June 26, just after the New York pilot had been taken on board, 350 miles from port. The steamer "Werkendam," of the Netherlands-American Line, was signaled and brought the "Dania" in under tow. The break occurred in the shaft tunnel.

An extensive fire occurred in San Francisco, Cal., last week, destroying four blocks in the manufacturing district, and involving a loss of about $1,500,000. One person was killed. The fire was with difficulty prevented from extending to the railway yards and warehouses.

A water-works tank at Attica, O., is reported as wrecked by wind on June 26. The tank was on a brick tower and was a part of a small water-works system, contracts for which were let in November, 1894. The contract for the brick tower was let at $1,522, and for the steel tank for $1,097. Mr. L. L. Sutton is clerk of the water-works trustees.

The Long Island R. R. has completed the extension of its block signal system from Jamaica to Floral Park —20 miles. There are 20 towers on this section, controlling 95 switches and 180 signals. The auto-manual system is used, the signals being automatically set at danger by the trains, and the signalmen being unable to lower the signals until the block governed has been cleared. The length of blocks averages about a mile. The Patenall electro-mechanical slot is used, as described and illustrated in our issue of April 4. The plant was put in by the Johnson Railroad Signal Co., of Rahway, N. J.

A crossing war between a steam railway and an electric railway in Ohio has been finally adjusted. The Akron & Cuyahoga Falls Rapid Transit Ry. built a viaduct over the line of the Cleveland, Akron & Columbus Ry. last spring, and failed to give it the clearance which the latter company demanded. The officers of the steam railway thereupon sent a locomotive and gang of men who pulled down the partly-completed viaduct where it came on the company's right of way. Indictments were brought against Mr. J. H. Barrett, General Manager, and Mr. J. J. Henry, Superintendent of the steam railway company, but under the amicable adjustment just effected, these indictments are not to be pressed, as the steam railway company agrees to rebuild the part of the viaduct which it destroyed and to pay half of the legal expenses.

A cable incline railway up Prospect Mountain, near Lake George, N. Y., has recently been opened for traffic. It is about 7,100 ft. long, with a total rise of 1,800 ft., the average grade being about 25%, and the maximum grade 35%. The line is in the form of a high and narrow S. It is single-track, 3 ft. gage, with a double-track turnout, and on the ties are guard timbers 8 × 10 ins., upon which a grip acts in case of the rope breaking. There are two cars, each seating 80 persons, and there is telephone communication between each car and the engineman in the power station at the summit. There are two hoisting engines, with cylinders 8 and 12 ins. diameter, developing 200 HP. when worked simple and 100 HP. when working compound. Steam is supplied by a Heine water-tube boiler of 200 HP., and a Westinghouse alternating dynamo furnishes current for lighting the railway stations and the hotel at the summit. The hotel and railway are owned by the Horison Improvement Co., of which Mr. Wm. M. Peck, of Glens Falls, N. Y., is President. The contract for the railway was taken by the Otis Engineering & Construction Co., of New York, and the work was designed by and carried out under the supervision of Mr. Thomas E. Brown, Jr., M. Am. Soc. C. E., Consulting Engineer to the company. Mr. C. F. Parker was the resident engineer in charge of the work. The contract for the entire construction and the erection of the plant was let to Mairs & Lewis, of New York, who were also the contractors for the Otis company's cable railway in the Catskills, described and illustrated in our issue of Aug. 18, 1892. We shall give a more complete description of the Prospect Mountain cable incline in a later issue.

## THE NEW BROOKLYN TERMINAL STATION OF THE BROOKLYN BRIDGE.

(With Inset.)

The new terminal arrangements and stations of the cable railway over the Brooklyn Bridge, which have been the subject of much discussion, and work upon which was delayed for so long that it began to seem doubtful whether the plans would ever be carried out, are now well advanced, and it appears probable that the new system will be ready to be put in operation during the present year, when it will soon be apparent whether the expected increase in traffic facilities will be attained. As to the terminal arrangements, it may be well to explain that as now constructed there are two side platforms separated by two tracks. Each incoming train discharges its passengers at one platform, and is then hauled by a locomotive out beyond the station and pushed back on the other track to receive passengers at the other platform. With the new arrangement there will be two island platforms, and four tracks. Incoming trains will run on either side of the arrival platform alternately, and will then be hauled out and pushed back on one or other side of the departure platform. This new arrangement is but an elaboration of the present tail-switching system, but it is claimed that trains can be run more frequently, and thus avoid the present crowding during the busy hours of the morning and evening. To avoid the use of facing switches, the rails of the two incoming and two outgoing tracks will be laid continuously across the bridge, being laid close together to form a double gantleted track along each present single track. This will necessitate the use of a duplicate cable and cable-driving plant.

The New York terminal was described and illustrated in detail in our issue of Nov. 8, 1894, and we give herewith similar particulars of the Brooklyn terminal, general descriptions of which were given in our issues of Feb. 9 and April 20, 1893. Work is progressing steadily on both terminals, and the Brooklyn station is now approaching completion. The reconstruction of the New York terminal is complicated by the fact that it has to be carried out on the site of the present station, but while the new Brooklyn terminal is beyond the present terminal, yet the design of the station is more complicated, for the reason that provision has had to be made in it for platforms for the elevated railways above the level of the platforms of the bridge railway. The difficulties of carrying out these works were described in our issue of April 18, 1895.

The new Brooklyn station is located on the western side of Washington St., extending over Sands and High Sts. It is intended chiefly for the use of passengers over the bridge, but provision is made also for the accommodation of passengers to or from the Brooklyn Elevated R. R. and the Kings County Elevated R. R. and the several surface railways reaching this terminal.

In plan the main part of the station is rectangular, 357 ft. 6 ins. long and 90 ft. wide, with two opposite projections or wings near each end, each 25 ft. long and 56 ft. 8 ins. wide, while extending from the northern end is an approach viaduct connecting the station with the bridge. The station has three floors: On the first or ground floor are retiring rooms and two ticket booths; on the second floor, placed longitudinally, are two passenger platforms and four tracks for the bridge railway, and on the third floor, placed transversely in each opposite pair of wings, are three passenger platforms and two tracks for the Brooklyn Elevated R. R., and also an intermediate longitudinal gallery connecting these wings. Between the first and second floors are two stairways, and between the second and third floors are nine stairways. At each end of the intermediate, longitudinal gallery, and connecting it with the three platforms of the elevated railway at that end by a stairway to each platform, is a stairway and gallery which spans the two tracks of the elevated railway. At each end of the bridge station are stairways leading directly from the elevated railway platforms to the bridge footway or to the street. There are ticket-sellers' boxes on the second and third floors, near the entrances to the stairways connecting the passenger platforms on either of these floors with those above or below.

The general system of construction is similar to that of the New York station, already described, and the general exterior appearance is also similar. The framework of the station building is of vertical columns for the outer walls and intermediate supports, horizontal girders and beams for the second and third floors, and trusses for the roofs. The outer walls are of paneled and shaped cast or wrought metal, with ample window area, and the interior walls and partitions are of brick or wood and glass. The floors are of brick arches between the girders and beams, surfaced with concrete, and the roofs are of wood on steel purlins, covered with sheet metal, slate and glass. Ornamental work of neat architectural design in the form of cast iron moldings, cornices, paneling, etc., is attached to the sides and gable ends of the structure, but no attempt has been made at an elaborate architectural design. The finished color of the ironwork is a light yellow. The approach viaduct is of wrought iron or steel vertical columns and horizontal girders and beams connected together; between the girders and beams are brick or terra cotta arches, surfaced with concrete. The contract for the station building, not including foundations, tracks or machinery, was let to the Phoenix Bridge Co., of Phoenixville, Pa.

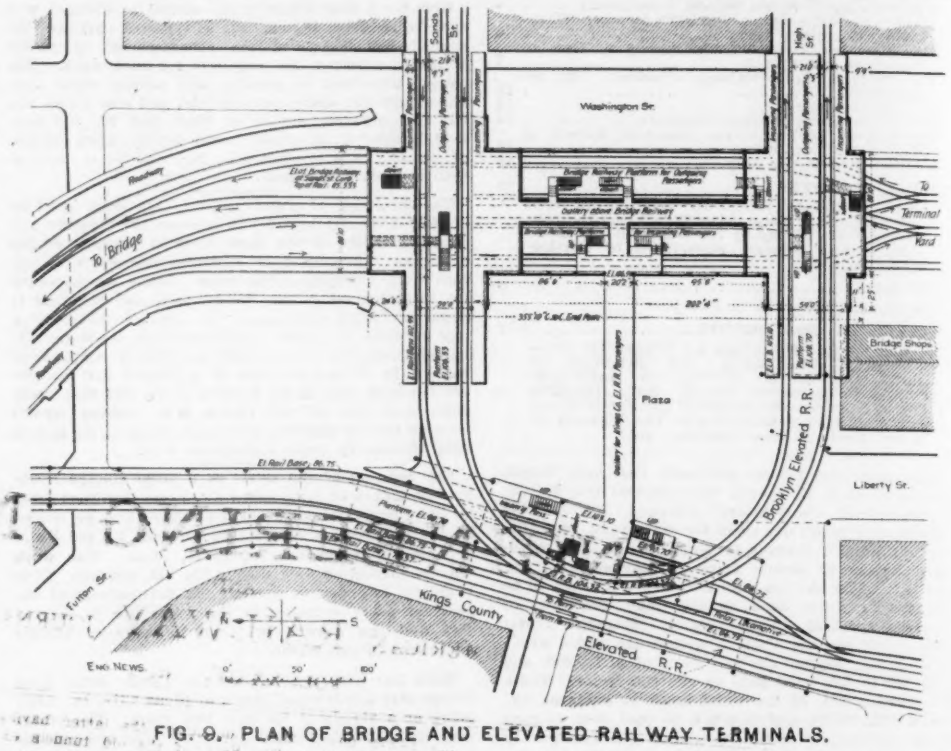


FIG. 9. PLAN OF BRIDGE AND ELEVATED RAILWAY TERMINALS.

The greater part of the station has been erected without trouble, as it is south of the present station, and only interferes with the south end of the latter. The present station will be removed and a viaduct approach built on its site, being a continuation of the present approaches, the grade of the tracks being unchanged through the station. The new station will have straight tracks, thus avoiding the inconvenience and danger incident to the curved tracks and platforms in the present station. The roadways have been widened by moving the stone parapets about 17 ft. further out, thus giving a more convenient connection with Sands St. The sidewalks on the Plaza and Washington St. sides of the station are to be covered by roofs carried by brackets riveted to the columns, as shown on the cross-section in our issue of April 20, 1893. The trainshed of the station has at each end a trainshed at right angles for the Brooklyn Elevated Railway, the latter crossing above the bridge railway tracks. The total length, including the transepts, is 355 ft. 10 ins. c. to c. of end posts, and the distance c. to c. of elevated railway stations is 261 ft. 4 ins. The width of bridge trainshed is 88 ft. 10 ins. c. to c. of columns.

At the level of the platforms of the elevated railway is a gallery 16 ft. wide, suspended from the roof trusses and running the whole length of the station between the elevated railway trainsheds, and stairways 6 ft. wide lead from this and connect the side and island platforms of the elevated railway with the two island platforms of the bridge railway below. The elevated railway has two tracks in each station, separated by a platform 21 ft. wide, and having side platforms 9 ft. 9 ins. wide. The clear height of edge of platform above rail base is 3 ft. 7¼ ins., and the clear width between platform edges is 9 ft. 3 ins. The bridge station has four tracks; one at each side and two in the middle of the station, separated by two island platforms 270 ft. long and 20 ft. wide. The height of edge of platform above rail base is 3 ft. 8 ins., and the clear width between platform is 24 ft. and between platform and side of building 12 ft. The middle tracks are 14 ft. c. to c. The two elevated railway stations will be connected by a loop over the Plaza and Fulton St., as shown on the plan, Fig. 9. The elevated station at the north end of the bridge station is already in operation. This loop is a plate girder structure with solid floor, and crosses above the Kings County Elevated R. R. structure.

The bridge trainshed is spanned by roof trusses 20 ft. 6 ins. apart, of the type shown in Fig. 4, which represents one of the main trusses, as indicated in the plan, Fig. 3. The span of truss is 88 ft. 10 ins. c. to c. of columns, or 87 ft. 4 ins. back to back of chord cover plates. The depth of truss is 13 ft. at the back and 10 ft. 4 5-16 ins. at the center. The angle of rise of roof or upper chord is 26° 33' 53". The lower chord has a radius of 82 ft. 2⅛ ins. in the central part, decreased to 12 ft. 6 13-16 ins. radius at the ends. The top chord is horizontal for a width of 22 ft. 3 ins. at the middle of the truss, and above this portion is a monitor or ventilator roof. The diagonal trusses, or valley trusses, B, Fig. 5, used at the intersection of the roofs of the bridge and elevated railway stations are 110 ft. .0⅜ in. long, 13 ft. 7 ins. at the back and 10 ft. 4 15-16 ins. deep at the middle. The top chord has an angle of 21° 41' 17" at each side, and is horizontal at the middle of the truss for a width of 28 ft. .0½ in. At the center of the span the chord angles are made continuous in one truss of each pair, while in the other trusses the chord angles and cover plates are cut. Generally the rivets are ¾ in. diameter. Rivet holes in steel, if punched, are afterward reamed to size, and not less than 1-16 in. of metal removed. In case of slight misfit the holes are reamed, no drifting being allowed. The ventilator roof trusses are 22 ft. 9¼ ins. span, spaced 20 ft. 6 ins., 25 ft. 4 ins. and up to 35 ft. 10 ins apart. They are connected by riveted trusses

with parallel chords, the depth of truss being 2 ft. 4 ins. The brace rods of the wind bracing pass through filler plates just below the top chord, and through the end posts. The general arrangement of wind bracing and connections is similar to that of the New York station, which we have already illustrated. The height from the street level at Sands St. is 26 ft. to the platforms of the bridge railway, and 44 ft. to those of the elevated railway.

The main roofs are covered with heavy slates of even tint and uniform size, 8 ins. wide and 16 ins. long, with the lower corners chipped off so as to form a hexagonal outline, they are laid over waterproof tarred roofing felt, the lap not less than 2½ ins., and completely bonded in the heading courses, at the eaves and elsewhere, and each is secured in place by two copper nails. Horizontal slats of sheet metal, hung centrally on pivots, will be inserted in openings in the sides which support the ventilator roofs. The flashings, counter flashings, ridge rolls, gutters and leaders will be of sheet copper, weighing not less than 20 ounces per sq. ft. The roof coverings of sheet metal are of bright charcoal IX. tin in sheets 20 × 10 ins. The ventilator slats and the panels, moldings and other parts for architectural finish of sheet metal are of galvanized iron not less than 1-30 in. thick.

All the end or gable trusses have solid web plates of ¼-in. metal, as shown by Fig. 1, which are relieved by ornamental work in cornices, moldings and panels, as already mentioned.

In open spaces in the main roofs and ventilator roofs are inserted roof lights, each consisting of plates of rolled or hammered glass ¼ in. thick, laid without lap or putty in a metal sash, which is part of the roof frame itself. Efficient means are provided, by the use of gutters on the under side and a part of the metal sash or otherwise, to collect and conduct away without dripping any moisture which may condense on the glass; also to prevent water which may fall on other parts of the roof from flowing over the roof lights. The joints between the glass and sash and between the sash and adjacent parts of the roof are to be made so as to be and remain thoroughly watertight. The Paradigm system is used, as shown in Fig. 8.

At the shops where the new metal work is wrought or cast, as well as at the site where the old metal is changed, all metal surfaces brought into contact before riveting together are given a heavy coat of linseed oil made thick with red lead, freshly and thoroughly mixed, and so put on that the spaces enclosed are completely filled. Before leaving the shops, all the new work is given a thick coat of this paint, suitably shaded with lampblack, and well brushed on, and allowed to dry hard before the parts are shipped. The tin roofing sheets, before laying, are given a coat of the same paint on each side. After erection all of the exposed woodwork will have a thick coat of linseed oil; then the joints and joint holes of the metal work will be filled flush and even with a suitable cement, and those of the woodwork well puttied, and the surfaces smoothly sandpapered. The lower parts of the columns and the exterior surfaces of the cast iron leaders and drain pipes, which will be below the first floor level, have a thick coating of hot bitumen, tempered so as to be tough and hard when cold, and finally two more coats of linseed oil, or of paint, for ornamentation of different colors for the several parts, will be applied to all the exposed wood and metal work. The roofing slates, after they are laid, and, if so required, certain parts of the brick work, will have one coat of linseed oil. All rust, cinder and sand scales must be removed from metallic surfaces and wire brushes or otherwise, and all surfaces made clean and free from moisture when a coat of oil or paint is applied, and this coat must be dry and hard before another one is put on. The oil used is to be the best light-colored boiled linseed. The pigments will be chiefly red or white lead, mixed with other pigments to secure the desired colors, the paint being thoroughly intermixed, with a due proportion of oil and pigment.

The entire space between the Plaza and the Washington St. sidewalks and the sidewalks on Sands and High Sts. will be enclosed, forming a large main hall, with toilet rooms adjoining and having several ticket offices. In each side panel will be a door and window, as shown by the elevation, but, of course, in cold weather a number of these entrances will be closed. Provision will be made for warming this hall. On the upper floor will be ticket offices for passengers from the elevated railways. Kosmocrete paving is laid around the building, and the main floor is paved with asphalt.

The general arrangement of tracks is shown in the sketch plan, Fig. 9, being similar to that at the New York station, except that at the north end the tracks lead out on a curve of 260 ft. radius, while at the south end there are connections to the storage tracks on the elevated yards, which yards are carried by a structure of steel columns and girders with brick arches. This structure is 100 to 140 ft. wide, and extends 870 ft. from the station back to Tillary St., where it is 25 ft. above the ground. The tracks in the present station are level, but there is a grade of 1% up from Sands St. and through the new station. There are eight storage tracks on this structure, accommodating 100 cars, and there are also tracks for repairs, etc. Underneath is a space for storing supplies, etc., and at one side are the shops. The course of the switching movements can be followed out by the arrows marked on the tracks.

The arrangement of the bridge station and the elevated railway stations appears somewhat complicated from this plan, but will be more readily understood by a comparison of the differences in levels, as shown by the figures marked on the plan. Fulton St. is here on a steep slope rising from the river, and the two main tracks of the Kings County Elevated R. R. ascend this grade from the terminal station at the ferry by a grade of about 4%, a dead-end spur track being carried out on the level to a platform for the use of passengers to and from the bridge. Sands St. and High St. slope up from Fulton St. to the bridge station, and the grade of the bridge tracks is slightly lower than that of the spur track above noted. Above the bridge tracks is the grade of the Brooklyn Elevated R. R. tracks, which cross above the bridge railway tracks, and will also cross over the tracks of the Kings County Elevated R. R. when the loop track is completed. The principal elevations of the parts of the different tracks in the station above water level in the East River, adopted as a datum plane, are as follows:

| | Feet. |
|---|---|
| K. Co. Elev. R. R. main tracks at Sands St. station | 76.370 |
| K. Co. Elev. R. R. main tracks above Sands St. station, and of K. Co. Elev. R. R. spur track for bridge passengers | 86.750 |
| Bridge railway tracks in bridge station | 85.533 |
| Bk. Elev. R. R. tracks through lower end of bridge station | 102.930 |
| Bk. Elev. R. R. tracks on Fulton St. loop | 104.320 |
| Bk. Elev. R. R. tracks through upper end of bridge station | 105.100 |

The traveler used in erection, Fig. 10, is about 80 ft. wide over the side towers, and has a clear span part, the elevation above the traveler rails being 22 ft., 46 ft. and 74 ft., respectively, while the total height to the top of the upper derrick mast is 92 ft. The high part of the structure is 34 ft. long, but the lower panel is carried out to a length of 59 ft., as shown in the cross-section, so that the first deck is of extra length, and forms a working platform to carry the hoisting engines and boilers, etc. The derrick booms are 18, 26, 30 and 40 ft. long. Each side of the traveler is carried by eight 21-in. wheels on a track of standard gage. This traveler was erected on tracks in the elevated terminal yard above mentioned, and commenced work at the south end of the new station, proceeding northward until it encountered the south end of the old station.

## A PIECE-RATE SYSTEM OF PAYING FOR LABOR.*

By Fred. W. Taylor, M. Am. Soc. M. E.

### Introduction.

The ordinary piece-work system involves a permanent antagonism between employers and men, and a certainty of punishment for each workman who reaches a high rate of efficiency. The demoralizing effect of this system is most serious. Under it, even the best workmen are forced continually to act the part of hypocrites, to hold their own in the struggle against the encroachments of their employers.

The system introduced by the writer, however, is directly the opposite, both in theory and in its results. It makes each workman's interests the same as that of his employer, pays a premium for high efficiency, and soon convinces each man that it is for his permanent advantage to turn out each day the best quality and maximum quantity of work.

The writer has endeavored in the following paper to describe the system of management introduced by him in the works of the Midvale Steel Co., of Philadelphia, which has been employed by them during the past ten years with the most satisfactory results. The system consists of three principal elements: (1) An elementary rate-fixing department. (2) The differential rate-system of piece-work. (3) What he believes to be the best method of managing men who work by the day.

### The Need of System in Handling Men.

Capital demands fully twice the return for money placed in manufacturing enterprises that it does for real estate or transportation ventures. And this probably represents the difference in the risk between these classes of investments. Among the risks of a manufacturing business, by far the greatest is that of bad management; and of the three managing departments, the commercial, the financiering, and the productive, the latter, in most cases, receives the least attention from those that have invested their money in the business, and contains the greatest elements of risk. This risk arises not so much from the evident mismanagement, which plainly discloses itself through occasional strikes and similar troubles, as from the daily more insidious and fatal failure on the part of the superintendents to secure anything even approaching the maximum work from their men and machines.

It is not unusual for the manager of a manufacturing business to go most minutely into every detail of the buying and selling and financiering, and arrange every element of these branches in the most systematic manner, and according to principles that have been carefully planned to insure the business against almost any contingency which may arise, while the manufacturing is turned over to a superintendent or foreman, with little or no restrictions as to the principles and methods which he is to pursue, either in the management of his men or the care of the company's plant.

Such managers belong distinctly to the old school of manufacturers; and among them are to be found, in spite of their lack of system, many of the best and most successful men of the country. They believe in men, not in methods, in the management of their shops; and what they would call system in the office and sales departments, would be called red tape by them in the factory. Through their keen insight and knowledge of character they are able to select and train good superintendents, who in turn secure good workmen; and frequently the business prospers under this system (or rather, lack of system) for a term of years.

The modern manufacturer, however, seeks not only to secure the best superintendents and workmen, but to surround each department of his manufacture with the most carefully woven network of system and method, which should render the business, for a considerable period, at least, independent of the loss of any one man, and frequently of any combination of men.

It is the lack of this system and method which, in the judgment of the writer, constitutes the greatest risk in manufacturing; placing, as it frequently does, the success of the business at the hazard of the health or whims of a few employees.

Even after fully realizing the importance of adopting the best possible system and methods of management for securing a proper return from employees and as an insurance against strikes and the carelessness and laziness of men, there are difficulties in the problem of selecting methods of management which shall be adequate to the purpose, and yet be free from red tape, and inexpensive.

The literature on the subject is meagre, especially that which comes from men of practical experience and observation. And the problem is usually solved, after but little investigation, by the adoption of the system with which the managers are most familiar, or by taking a system which has worked well in similar lines of manufacture.

### The Day-Work Plan.

The simplest of all systems is the "day-work" plan, in which the employees are divided into certain classes, and a standard rate of wages is paid to each class of men; the laborers all receiving one rate of pay, the machinists all another rate, and the engineers all another, etc. The men are paid according to the position which they fill, and not according to their individual character, energy, skill, and reliability.

The effect of this system is distinctly demoralizing and levelling; even the ambitious men soon conclude that since there is no profit to them in working hard, the best thing for them to do is to work just as lit-

* Condensed from a paper read at the Detroit meeting of the American Society of Mechanical Engineers.

tle as they can and still keep their position. And under these conditions the invariable tendency is to drag them all down even below the level of the medium.

The proper and legitimate answer to this herding of men together into classes, regardless of personal character and performance, is the formation of the labor union, and the strike, either to increase the rate of pay and improve conditions of employment, or to resist the lowering of wages and other encroachments on the part of employers.

The necessity for the labor union, however, disappears when men are paid, and not positions; that is, when the employers take pains to study the character and performance of each of their employees and pay them accordingly, when accurate records are kept of each man's attendance, punctuality, the amount and quality of work done by him, and his attitude towards his employers and fellow-workmen. As soon as the men recognize that they have free scope for the exercise of their proper ambition, that as they work harder and better their wages are from time to time increased, and that they are given a better class of work to do—when they recognize this, the best of them have no use for the labor union.

Every manufacturer must from necessity employ a certain amount of day labor which cannot come under the piece-work system; and yet how few employers are willing to go to the trouble and expense of the slight organization necessary to handle their men in this way? How few of them realize that, by the employment of an extra clerk and foreman, and a simple system of labor returns, to record the performance and readjust the wages of their men, so as to stimulate their personal ambition, the output of a gang of 20 or 30 men can be readily doubled in many cases, and at a comparatively slight increase of wages per capita!

### The Piece-Work Plan.

The inherent and most serious defect of even the best managed day-work lies in the fact that there is nothing about the system that is self-sustaining. When once the men are working at a rapid pace, there is nothing but the constant unremitting watchfulness and energy of the management to keep them there; while with every form of piece-work each new rate that is fixed insures a given speed for another section of work, and to that extent relieves the foreman from worry.

The theory upon which the ordinary system of piece-work operates to the benefit of the manufacturer is exceedingly simple. Each workman, with a denite price for each job before him, contrives a way of doing it in a shorter time, either by working harder or by improving his method; and he thus makes a larger profit. After the job has been repeated a number of times at the more rapid rate, the manufacturer thinks that he should also begin to share in the gain, and therefore reduces the price of the job to a figure at which the workman, although working harder, earns, perhaps, but little more than he originally did when on day-work.

The actual working of the system, however, is far different. Even the most stupid man, after receiving two or three piece-work "cuts" as a reward for his having worked harder, resents this treatment and seeks a remedy for it in the future. Thus begins a war, generally an amicable war, but none the less a war, between the workmen and the management. The latter endeavors by every means to induce the workmen to increase the output, and the men gage the rapidity with which they work, so as never to earn over a certain rate of wages, knowing that if they exceed this amount the piece-work price will surely be cut, sooner or later.

But the war is by no means restricted to piece-work. Every intelligent workman realizes the importance, to his own interest, of starting in on each new job as slowly as possible. There are few foremen or superintendents who have anything but a general idea as to how long it should take to do a piece of work that is new to them. Therefore, before fixing a piece-work price, they prefer to have the job done for the first time by the day. They watch the progress of the work as closely as their other duties will permit and make up their minds how quickly it can be done. It becomes the workman's interest then to go just as slowly as possible, and still convince his foreman that he is working well.

The extent to which, even in our largest and best-managed establishments, this plan of holding back on the work—"marking time," or "soldiering," as it is called—is carried on by the men, can scarcely be understood by any one who has not worked among them. It is by no means uncommon for men to work at the rate of one-third, or even one-quarter, their maximum speed, and still preserve the appearance of working hard. And when a rate has once been fixed on such a false basis, it is easy for the men to nurse successfully "a soft snap" of this sort through a term of years, earning in the meanwhile just as much wages as they think they can without having the rate cut.

Thus arises a system of hypocrisy and deceit on the part of the men which is thoroughly demoralizing, and which has led many workmen to regard their employers as their natural enemies, to be opposed in whatever they want, believing that whatever is for the interest of the management must necessarily be to their detriment. The effect of this system of piece-work on the character of the men is, in many cases, so serious as to make it doubtful whether, on the whole, well-managed day-work is not preferable.

### The Gain-Sharing and Premium Plans.

Perhaps the most successful modification of the ordinary system of piece-work is the "gain-sharing plan." This was invented by Mr. Henry R. Towne, in 1886, and has since been extensively and successfully applied by him in the Yale & Towne Mfg. Co., at Stamford, Conn. It was admirably described in a paper which he read before this Society in 1888. This system of paying men is, however, subject to the serious, and I think fatal, defect that it does not recognize the personal merit of each workman; the tendency being rather to herd men together and promote trade unionism, than to develop each man's individuality.

A still further improvement of this method was made by Mr. F. A. Halsey, and described by him in a paper entitled "The Premium Plan of Paying for Labor," and presented to this Society in 1891. (Eng. News, June 20, 1891.) Mr. Halsey's plan allows free scope for each man's personal ambition, which Mr. Towne's does not.

Messrs. Towne and Halsey's plans consist briefly in recording the cost of each job as a starting-point at a certain time; then, if, through the effort of the workmen in the future, the job is done in a shorter time and at a lower cost, the gain is divided among the workmen and the employer in a definite ratio, the workmen receiving, say, one-half, and the employer one-half.

Under this plan, if the employer lives up to his promise, and the workman has confidence in his integrity, there is the proper basis for co-operation to secure sooner or later a large increase in the output of the establishment. Yet there still remains the temptation for the workman to "soldier" or hold back while on day-work, which is the most difficult thing to overcome. And in this, as well as in all the systems heretofore referred to, there is the common defect: that the starting-point from which the first rate is fixed is unequal and unjust. Some of the rates may have resulted from records obtained when a good man was working close to his maximum speed, while others are based on the performance of a medium man at one-third or one-quarter speed. From this follows a great inequality and injustice in the reward even of the same man when at work on different jobs. The result is far from a realization of the ideal condition in which the same return is uniformly received for a given expenditure of brains and energy. Other defects in the gain-sharing plan, and which are corrected by the differential-rate system, are: (1) That it is slow and irregular in its operation in reducing costs, being dependent upon the whims of the men working under it. (2) That it fails to especially attract first-class men and discourage inferior men. (3) That it does not automatically insure the maximum output of the establishment per man and machine.

### Co-operative Enterprises.

Co-operation, or profit-sharing, has entered the mind of every student of the subject, as one of the possible and most attractive solutions of the problem; and there have been certain instances, both in England and France, of at least a partial success of co-operative experiments. So far as I know, however, these trials have been made either in small towns, remote from the manufacturing centers, or in industries which in many respects are not subject to ordinary manufacturing conditions.

Co-operative experiments have failed, and, I think, are generally destined to fail, for several reasons; the first and most important of which is, that no form of co-operation has yet been devised in which each individual is allowed free scope for his personal ambition. This always has been and will remain a more powerful incentive to exertion than a desire for the general welfare. The few misplaced drones, who do the loafing and share equally in the profits with the rest, under co-operation are sure to drag the better men down toward their level. The second and almost equally strong reason for failure lies in the remoteness of the reward. The average workman (I don't say all men) cannot look forward to a profit which is six months or a year away. The nice time which they are sure to have to-day, if they take things easily, proves more attractive than hard work, with a possible reward to be shared with others six months later.

Other and formidable difficulties in the path of co-operation are, the equitable division of the profits, and the fact that, while workmen are always ready to share the profits, they are neither able nor willing to share the losses. Further than this, in many cases, it is neither right nor just that they should share either in the profits or the losses, since these may be due in great part to causes entirely beyond their influence or control, and to which they do not contribute.

### A Basis for Co-operation.

It is the opinion of the writer that the basis for harmonious co-operation between workmen and employers lies in the two following facts: (1) That the workmen in nearly every trade can and will materially increase their present output per day, providing they are assured of a permanent and larger return for their time than they have heretofore received. (2) That the employers can well afford to pay higher wages per piece even permanently, providing each man and machine in the establishment turns out a proportionately larger amount of work.

The truth of the latter statement arises from the well-recognized fact that, in most lines of manufacture, the indirect expenses equal or exceed the wages paid directly to the workmen, and that these expenses remain approximately constant, whether the output of the establishment is great or small. From this it follows that it is always cheaper to pay higher wages to the workmen when the output is proportionately increased; the diminution in the indirect portion of the cost per piece being greater than the increase in wages. Many manufacturers, in considering the cost of production, fail to realize the effect that the volume of output has on the cost. They lose sight of the fact that taxes, insurance, depreciation, rent, interest, salaries, office expenses, miscellaneous labor, sales expenses, and frequently the cost of power (which in the aggregate amount to as much as wages paid to workmen), remain about the same whether the output of the establishment is great or small.

### The Rate-Fixing Department.

In our endeavor to solve the piece-work problem by the application of the two fundamental facts above referred to, let us consider the obstacles in the path of harmonious co-operation, and suggest a method for their removal.

The most formidable obstacle is the lack of knowledge on the part of both the men and the management (but chiefly the latter) of the quickest time in which each piece of work can be done; or, briefly, the lack of accurate time-tables for the work of the place.

The remedy for this trouble lies in the establishment in every factory of a proper rate-fixing department; a department which shall have equal dignity and command equal respect with the engineering and managing departments, and which shall be organized and conducted in an equally scientific and practical manner.

The rate-fixing, as at present conducted, even in our best-managed establishments, is very similar to the mechanical engineering of fifty or sixty years ago. Mechanical engineering at that time consisted in imitating machines which were in more or less successful use, or in guessing at the dimensions and strength of the parts of a new machine; and as the parts broke down or gave out, in replacing them with stronger ones. Thus each new machine presented a problem almost independent of former designs, and one which could only be solved by months or years of practical experience and a series of break-downs. Modern engineering, however, has become a study, not of individual machines, but of the resistance of materials, the fundamental principles of mechanics, and of the elements of design.

On the other hand, the ordinary rate-fixing (even the best of it), like the old-style engineering, is done by a foreman or superintendent, who, with the aid of a clerk, looks over the record of the time in which a whole job was done as nearly like the new one as can be found, and then guesses at the time required to do the new job. No attempt is made to analyze and time each of the classes of work, or elements of which a job is composed; although it is a far simpler task to resolve each job into its elements, to make a careful study of the quickest time in which each of the elementary operations can be done, and then to properly classify, tabulate, and index this information, and use it when required for rate-fixing, than it is to fix rates with even an approximation to justice, under the common system of guessing.

This elementary system of fixing rates has been in successful operation for the past ten years, on work complicated in its nature, and covering almost as wide a range of variety as any manufacturing that the writer knows of. In 1883, while foreman of the machine shop of the Midvale Steel Co., of Philadelphia, it occurred to the writer that it was simpler to time each of the elements of the various kinds of work done in the place, and then find the quickest time in which each job could be done, by summing up the total times of its component parts, than it was to

search through the records of former jobs, and guess at the proper price. After practicing this method of rate-fixing himself for about a year, as well as circumstances would permit, it became evident that the system was a success. The writer then established the rate-fixing department, which has given out piece-work prices in the place ever since.

This department far more than paid for itself from the very start; but it was several years before the full benefits of the system were felt, owing to the fact that the best methods of making and recording time observations of work done by the men, as well as of determining the maximum capacity of each of the machines in the place, and of making working-tables and time-tables, were not at first adopted.

Before the best results were finally attained in the case of work done by metal-cutting tools, such as lathes, planers, boring mills, etc., a long and expensive series of experiments was made, to determine, formulate, and finally practically apply to each machine the law governing the proper cutting speed of tools; namely, the effect on the cutting speed of altering any one of the following variables; the shape of the tool (i. e., lip angle, clearance angle, and the line of the cutting edge), the duration of the cut, the quality or hardness of the metal being cut, the depth of the cut, and the thickness of the feed or shaving.

It is the writer's opinion that a more complicated and difficult piece of rate-fixing could not be found than that of determining the proper price for doing all kinds of machine work on miscellaneous steel and iron castings and forgings, which vary in their chemical composition from the softest iron to the hardest tool steel. Yet this problem was solved through the rate-fixing department and the "differential rate," with the final result of completely harmonizing the men and the management, in place of the constant war that existed under the old system. At the same time, the quality of the work was improved, and the output of the machinery and the men was doubled, and, in many cases, trebled. At the start there was naturally great opposition to the rate-fixing department, particularly to the man who was taking time observations of the various elements of the work; but when the men found that rates were fixed without regard to the records of the quickest time in which they had actually done each job, and that the knowledge of the department was more accurate than their own, the motive for hanging back or "soldiering" on this work ceased, and with it the greatest cause for antagonism and war between the men and the management.

As an illustration of the great variety of work to which elementary rate-fixing has already been successfully applied, the writer would state that, while acting as general manager of two large sulphite pulp mills, he directed the application of piece-work to all of the complicated operations of manufacturing throughout one of these mills, by means of elementary rate-fixing, with the result, within 18 months, of more than doubling the output of the mill.

The difference between elementary rate-fixing and the ordinary plan can perhaps be best explained by a simple illustration. Suppose the work to be planing a surface on a piece of cast iron. In the ordinary system the rate-fixer would look through his records of work done by the planing machine, until he found a piece of work as nearly as possible similar to the proposed job, and then guess at the time required to do the new piece of work. Under the elementary system, however, some such analysis as the following would be made:

| Work done by man. | Minutes. |
|---|---|
| Time to lift piece from floor to planer table.... | —— |
| " " level and set work true on table..... | —— |
| " " put on stops and bolts..... | —— |
| " " remove " " " ..... | —— |
| " " " piece to floor..... | —— |
| " " clean machine..... | —— |
| **Work done by machine.** | **Minutes.** |
| Time to rough off cut ¼ in. thick, 4 ft. long, 2½ ins. wide..... | —— |
| Time to rough off cut ¼ in. thick, 3 ft. long, 12 ins. wide, etc..... | —— |
| Time to finish cut 4 ft. long, 2½ ins. wide..... | —— |
| " " " " 3 " " 12 " " etc.... | —— |
| Total ..... | —— |
| Add —% for unavoidable delays..... | —— |

It is evident that this job consists of a combination of elementary operations, the time required to do each of which can be readily determined by observation. This exact combination of operations may never occur again, but elementary operations similar to these will be performed in differing combinations almost every day in the same shop. A man whose business it is to fix rates soon becomes so familiar with the time required to do each kind of elementary work performed by the men that he can write down the time from memory. In the case of that part of the work which is done by the machine the rate-fixer refers to tables which are made out for each machine, and from which he takes the time required for any combination of breadth, depth, and length of cut.

## The Differential Rate System of Piece-Work.

While, however, the accurate knowledge of the quickest time in which work can be done, obtained by the rate-fixing department and accepted by the men as standard, is the greatest and most important step towards obtaining the maximum output of the establishment, it is one thing to know how much work can be done in a day, and an entirely different matter to get even the best men to work at their fastest speed or anywhere near it.

The means which the writer has found to be by far the most effective in obtaining the maximum output of a shop, and which, so far as he can see, satisfies the legitimate requirements, both of the men and the management, is the differential rate system of piece-work. This consists briefly in paying a higher price per piece, or per unit, or per job, if the work is done in the shortest possible time, and without imperfections, than is paid if the work takes a longer time or is imperfectly done.

To illustrate: Suppose 20 units or pieces to be the largest amount of work of a certain kind that can be done in a day. Under the differential rate system, if a workman finishes 20 pieces per day, and all of these pieces are perfect, he receives, say, 15 cts. per piece, making his pay for the day $15 \times 20 = \$3$. If, however, he works too slowly and turns out, say, only 19 pieces, then, instead of receiving 15 cts. per piece he gets only 12 cts. per piece, making his pay for the day $12 \times 19 = \$2.28$, instead of $3 per day. If he succeeds in finishing 20 pieces, some of which are imperfect, then he should receive a still lower rate of pay, say, 10 cts. or 5 cts. per piece, according to circumstances, making his pay for the day $2, or only $1, instead of $3.

It will be observed that this style of piece-work is directly the opposite of the ordinary plan. To make the difference between the two methods more clear, supposing, under the ordinary system of piece-work, that the workman has been turning out 16 pieces per day, and has received 15 cts. per piece, then his day's wages would be $15 \times 16 = \$2.40$. Through extra exertion he succeeds in increasing his output to 20 pieces per day, and thereby increases his pay to $15 \times 20 = \$3$. The employer, under the old system, however, concludes that $3 is too much for the man to earn per day, since other men are only getting from $2.25 to $2.50, and therefore cuts the price from 15 cts. per piece to 12 cts., and the man finds himself working at a more rapid pace, and yet earning only the same old wages, $12 \times 20 = \$2.40$ per day. What wonder that men do not care to repeat this performance many times?

Whether co-operation, the differential plan, or some other form of piece-work be chosen in connection with elementary rate-fixing, as the best method of working, there are certain fundamental facts and principles which must be recognized and incorporated in any system of management, before true and lasting success can be attained; and most of these facts and principles will be found to be not far removed from what the strictest moralists would call justice. The most important of these facts is, that men will not do an extraordinary day's work for an ordinary day's pay; and any attempt on the part of employers to get the best work out of their men and give them only the standard wages paid by their neighbors will surely be, and ought to be, doomed to failure.

Justice, however, not only demands for the workman an increased reward for a large day's work, but should compel him to suffer an approximate loss in case his work falls off either in quantity or quality. It is quite as important that the deductions for bad work should be just, and graded in proportion to the shortcomings of the workman, as that the reward should be proportional to the work done. The fear of being discharged, which is practically the only penalty applied in many establishments, is entirely inadequate to producing the best quantity and quality of work; since the workmen find that they can take many liberties before the management makes up its mind to apply this extreme penalty.

It is clear that the differential rate satisfies automatically, as it were, the above conditions of properly graded rewards and deductions. Whenever a workman works for a day (or even a shorter period) at his maximum, he receives under this system unusually high wages; but when he falls off either in quantity or quality from the highest rate of efficiency his pay falls below even the ordinary.

The lower differential rate should be fixed at a figure which will allow the workman to earn scarcely an ordinary day's pay when he falls off from his maximum pace, so as to give him every inducement to work hard and well.

The exact percentage beyond the usual standard which must be paid to induce men to work to their maximum, varies with different trades and with different sections of the country. And there are places in the United States where the men (generally speaking) are so lazy and demoralized that no sufficient inducement can be offered to make them do a full day's work.

It is not, however, sufficient that each workman's ambition should be aroused by the prospect of larger pay at the end of even a comparatively short period of time. The stimulus to maximum exertion should be a daily one.

This involves such vigorous and rapid inspection and returns as to enable each workman in most cases to know each day the exact result of his previous day's work—i. e., whether he has succeeded in earning his maximum pay, and exactly what his losses are for careless or defective work. Two-thirds of the moral effect, either of a reward or penalty, is lost by even a short postponement.

It will again be noted that the differential rate system forces this condition both upon the management and the workmen, since the men, while working under it, are above all anxious to know at the earliest possible minute whether they have earned their high rate or not. And it is equally important for the management to know whether the work has been properly done.

As far as possible each man's work should be inspected and measured separately, and his pay and losses should depend upon his individual efforts alone. It is, of course, a necessity that much of the work of manufacturing—such, for instance, as running rolling trains, hammers, or paper machines—should be done by gangs of men who co-operate to turn out a common product, and that each gang of men should be paid a definite price for the work turned out, just as if they were a single man. In the distribution of the earnings of a gang among its members, the percentage which each man receives should, however, depend not only upon the kind of work which each man performs, but upon the accuracy and energy with which he fills his position. In this way the personal ambition of each of a gang of men may be given its proper scope. Again, we find the differential rate acting as a most powerful lever to force each man in a gang of workmen to do his best; since if, through the carelessness or laziness of any one man, the gang fails to earn its high rate, the drone will surely be obliged by his companions to do his best the next time, or else get out. A great advantage of the differential rate system is that it quickly drives away all inferior workmen, and attracts the men best suited to the class of work to which it is applied; since none but really good men can work fast enough and accurately enough to earn the high rate; and the low rate should be made so small as to be unattractive even to an inferior man. If for no other reason than it secures to an establishment a quick and active set of workmen, the differential rate is a valuable aid, since men are largely creatures of habit; and if the piece-workers of a place are forced to move quickly and work hard, the day-workers soon get into the same way, and the whole shop takes on a more rapid pace.

Of the two devices for increasing the output of a shop, the differential rate and the scientific rate-fixing department, the latter is by far the more important. The differential rate is invaluable at the start, as a means of convincing men that the management is in earnest in its intention of paying a premium for hard work; and it at all times furnishes the best means of maintaining the top notch of production; but when, through its application, the men and the management have come to appreciate the mutual benefit of harmonious co-operation and respect for each other's rights, it ceases to be an absolute necessity. On the other hand, the rate-fixing department, for an establishment doing a large variety of work, becomes absolutely indispensable. The longer it is in operation, the more necessary it becomes.

The term "rate-fixing department" has rather a formidable sound. In fact, however, that department should consist in most establishments of one man, who, in many cases, need give only a part of his time to the work. When the manufacturing operations are uniform in character, and repeat themselves day after day—as, for instance, in paper or pulp mills—the whole work of the place can be put upon piece-work in a comparatively short time; and when once proper rates are fixed, the rate-fixing department can be dispensed with, at any rate until some new line of manufacture is taken up.

The system of differential rates was first applied by the writer to a part of the work in the machine shop of the Midvale Steel Co., in 1884. Its effect in increasing and then maintaining the output of each machine to which it was applied was almost immediate, and so remarkable that it soon came into high favor, with both the men and the management. It was gradually applied to a great part of the work of the establishment, with the result, in combination with the rate-fixing department, of doubling, and in many cases trebling, the output, and at the same time increasing instead of diminishing the accuracy of the work.

In cases where large and expensive machines are used, such as paper machines, steam hammers, or rolling mills, in which a large output is dependent

upon the severe manual labor as well as the skill of the workmen (while the chief cost of production lies in the expense of running the machines rather than in the wages paid), it has been found of great advantage to establish two or three differential rates, offering a higher and higher price per piece or per ton as the maximum possible output is approached.

Indirect Benefits from Elementary Rate-Fixing.

As before stated not the least of the benefits of elementary rate-fixing are the indirect results. The careful study of the capabilities of the machines, and the analysis of the speeds at which they must run, before differential rates can be fixed, which will insure their maximum output, almost invariably result in first indicating and then correcting the defects in their design, and in the method of running and caring for them.

In the case of the Midvale Steel Co., to which I have already referred, the machine shop when equipped with standard tools furnished by the best makers, and the study of these machines, such as lathes, planers, boring mills, etc., which was made in fixing rates, developed the fact that they were none of them designed and speeded so as to cut steel to the best advantage. As a result, this company has demanded alterations from the standard in almost every machine which they have bought during the past eight years. They have themselves been obliged to superintend the design of many special tools which would not have been thought of had it not been for elementary rate-fixing. But what is, perhaps, of more importance still, the rate-fixing department has shown the necessity of carefully systematizing all of the small details in the running of each shop; such as the care of belting, the proper shape for cutting tools, and the dressing, grinding, and issuing same, oiling machines, issuing orders for work, obtaining accurate labor and material returns, and a host of other minor methods and processes. These details, which are usually regarded as of comparatively small importance, and many of which are left to the individual judgment of the foreman and workmen, are shown by the rate-fixing department to be of paramount importance in obtaining the maximum output, and to require the most careful and systematic study and attention in order to insure uniformity and a fair and equal chance for each workman. Without this preliminary study and systematizing of details, it is impossible to apply sucessfully the differential rate in most establishments.

The first case in which a differential rate was applied furnishes a good illustration of what can be accomplished by it. A standard steel forging, many thousands of which are used each year, had for several years been turned at the rate of from four to five per day under the ordinary system of piece-work, 50 cts. per piece being the price paid for the work. After analyzing the job and determining the shortest time required to do each of the elementary operations of which it was composed, and then summing up the total, the writer became convinced that it was possible to turn ten pieces a day. To finish the forgings at this rate, however, the machinists were obliged to work at their maximum pace from morning to night, and the lathes were run as fast as the tools would allow, and under a heavy feed. It will be appreciated that this was a big day's work, both for men and machines, when it is understood that it involved removing, with a single 16-in. lathe, having two saddles, an average of more than 800 lbs. of steel chips in ten hours. In place of the 50-ct. rate that they had been paid before, they were given 35 cts. per piece when they turned them at the speed of 10 per day, and when they produced less than 10, they received only 25 cts. per piece. It took considerable trouble to induce the men to turn at this high speed, since they did not at first fully appreciate that it was the intention of the firm to allow them to earn permanently at the rate of $3.50 per day. But from the day they first turned 10 pieces to the present time, a period of more than ten years, the men who understood their work have scarcely failed a single day to turn at this rate. Throughout that time, until the beginning of the recent fall in the scale of wages throughout the country, the rate was not cut. During this whole period the competitors of the company never succeeded in averaging over half of this production per lathe, although they knew and even saw what was being done at Midvale. They, however, did not allow their men to earn over from $2 to $2.50 per day, and so never even approached the maximum output.

Relations Between Employers and Employees.

There has never been a strike by men working under differential rates, although these rates have been applied at the Midvale Steel Works for the past ten years; and the steel business has proved during this period the most fruitful field for labor organizations and strikes. And this notwithstanding the Midvale Co. has never prevented its men from joining any labor organization. All of the best men in the company saw clearly that the success of a labor organization meant the lowering of their wages, in order that the inferior men might earn more, and, of course, could not be persuaded to join.

I attribute a great part of this success in avoiding strikes to the high wages which the best men were able to earn with the differential rates, and to the pleasant feeling fostered by this system; but this is by no means the whole cause. It has for years been the policy of that company to stimulate the personal ambition of every man in their employ, by promoting them either in wages or position whenever they deserved it, and the opportunity came. A careful record has been kept of each man's good points as well as his shortcomings, and one of the principal duties of each foreman was to make this careful study of his men, so that substantial justice could be done to each. When men, throughout an establishment, are paid varying rates of day-work wages, according to their individual worth, some being above and some below the average, it cannot be for the interest of those receiving high pay to join a union with the cheap men.

No system of management, however good, should be applied in a wooden way. The proper personal relations should always be maintained between the employers and men; and even the prejudices of the workmen should be considered in dealing with them. The employer who goes through his works with kid gloves on, and is never known to dirty his hands or clothes, and who either talks to his men in a condescending or patronizing way, or else not at all, has no chance whatever of ascertaining their real thoughts or feelings.

Above all is it desirable that men should be talked to on their own level by those who are over them. Each man should be encouraged to discuss any trouble which he may have, either in the works or outside, with those over him. Men would far rather even be blamed by their bosses, especially if the "tearing out" has a touch of human nature and feeling in it, than to be passed by day after day without a word, and with no more notice than if they were part of the machinery. The opportunity which each man should have of airing his mind freely, and having it out with his employers, is a safety-valve; and if the superintendents are reasonable men, and listen to, and treat with respect what their men have to say, there is absolutely no reason for labor unions and strikes.

It is not the large charities (however generous they may be) that are needed or appreciated by workmen, such as the founding of libraries and starting workingmen's clubs, so much as small acts of personal kindness and sympathy, which establish a bond of friendly feeling between them and their employers.

From what the writer has said he is afraid that many readers may gain the impression that he regards elementary rate-fixing and the differential rate as a sort of panacea for all human ills. This is, however, far from the case. While he regards the possibilities of these methods as great, he is of the opinion, on the contrary, that this system of management will be adopted by but few establishments, in the near future, at least; since its really successful application not only involves a thorough organization, but requires the machinery and tools throughout the place to be kept in such good repair that it will be possible for the workmen each day to produce their maximum output. But few manufacturers will care to go to this trouble until they are forced to. It is his opinion that the most successful manufacturers, those who are always ready to adopt the best machinery and methods when they see them, will gradually avail themselves of the benefits of scientific rate-fixing; and that competition will compel the others to follow slowly in the same direction.

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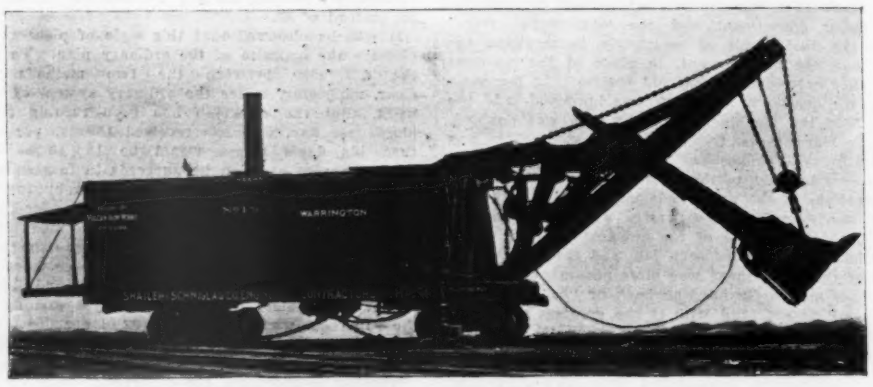
The cost of work now in hand and for which money is now available on U. S. government buildings amounts to about $9,300,000.

## THE WARRINGTON STEAM SHOVEL.

For the service which steam shovels are nowadays frequently called on to perform, great strength and durability are essential elements. Their efficiency in heavy work depends upon the first, and their economical operation upon the other. It has been the aim of the Vulcan Iron Works, of Chicago, to combine in the highest degree these features in the shovels they are now building for work on Section A of the Chicago Drainage Canal.

The car is mounted on Fox pressed steel trucks of 8,000 lbs. capacity, and is 35 ft. long, 10 ft. wide over all. The frame is made entirely of steel, the side sills of 15-in. channels and the intermediate sills of 15-in. I-beams, connected by steel plate diaphragms and covered by heavy steel plates. All strains transmitted from the crane, except those coming directly to its foot, are received at the top of the front corner posts of the car body. From these points extend the jack-arms, the front cross brace, the side tie braces and the diagonal body tie brace. These braces form with the corner posts and the floor of the car a triangular wedge terminating over the bolster line of the rear truck. The jack arms are pin-connected to the power jacks, which are stayed to the car body by two I-beams and a triangular-trussed brace, all pin-connected to the car and to the power jacks. The crane is of the rigid type, and is pin-connected to the structure above and the step casting below. The turntable is overhead, and is of the largest practicable diameter. The crane may be raised and lowered by the main engine. No castings are incorporated in the structure, save when necessary to form a bearing surface.




THE WARRINGTON STEAM SHOVEL.

The dipper is thrust into the bank by means of a double-cylinder engine attached to the crane. The cylinders are 9 × 9 ins., and the valves are flat slides operated by a compact yet accessible reversing gear, which insures economy of steam. The strains in this engine are transmitted through steel rods instead of the common cast iron frame, and the design is such that no possible twisting of the crane can work injury to the engine. The dipper and handle are of steel throughout, and are of novel form. The handle is pin-connected to the dipper, the cutting angle of the latter being adjustable. These parts have no castings, except the rack, which is, however, of unprecedented strength.

Power for hoisting, swinging, propelling and jacking is derived from the main engine. The cylinders of this engine are 12 × 12 ins., and are powerfully geared. The friction clutches are of the band type, and are operated by a novel form of mechanism, which avoids the necessity of steam cylinders. The engine has a reversible valve gear of a type much used by the Vulcan Iron Works. The boiler is of the locomotive type, and is designed with special reference to the prevention of priming.

Of the shovel as a whole it may be said that while possessing ample strength in every part, it is at the same time of the lightest practicable weight for its type and power. This very desirable result has been attained by a careful consideration of the working strains, and by the use of wrought steel to the exclusion of castings, where practicable. Many of the novel features form the subject of pending applications for patents.

## STEAM-PIPE EXPLOSION ON THE LAKE STEAMER "CHRISTOPHER COLUMBUS."

The bursting of a valve and fitting on the main steampipe of the whaleback passenger steamer "Christopher Columbus," on a trip from Milwaukee to Chicago, June 22, was recorded in our issue of last week, and we give below an abstract of the testimony of the engineer and a government inspector, as published in the Chicago "Times-Herald." A fireman and two coal-passers died from the effects of inhaling the steam, and 12 persons were badly scalded. The steamer was first run during the Columbian Exhibition of 1893, and was described and illustrated in our issue of May 18, 1893:

William L. Webster, the chief engineer, said that the accident occurred between 7:30 and 7:45 Saturday night, when the connection or main pipe on the after starboard boiler broke. He was in the engine room, 12 ft. from the break in the pipe. He first tried to shut off the two main stop valves, but failed, as the steam drove him away. He stepped outside the railing to catch his breath, and then started for the stop valves in the boiler. The first one he found broken, and he could do nothing with it. He was again driven away by the steam, and went up to the shell deck to try to get in from above. He started down a stairway in a turret, but was a third time driven back by the steam. He thereupon returned to the engine room, crept along to the stop valves on the port side, and after several attempts shut those three valves. Working his way around to the starboard side coming aft, he shut off two starboard valves. The third one he could not shut, as it was broken below the valve. He went to the gangway to get air and let the steam clear away. He had to wait until the boiler emptied itself, and then crept into the boiler room to shut off some smaller pipes leading into it, and that stopped the escape of steam. He then gave orders to have all the fires under the boilers put out. He found all the employees were out of the fire hold, and helped to take care of them for a few minutes, after which he had connections made in three boilers, again got up steam and proceeded toward Chicago, arriving about 3 a. m.

He said it was a cast iron fitting that broke. He thought he detected a flaw in the metal in examining it after the accident. The fitting had been in use three seasons, and he had no other explanation for the breaking. The steamer's government permit allowed him to carry 170 lbs. of steam, and he was carrying 160 lbs. at the time of the accident, which was a usual pressure. He declared the steamer was not racing with any other boat when the accident occurred.

He admitted the steamer left Milwaukee with only five boilers fired up. At the time of the accident six boilers were making steam, but he was not very certain when the sixth had been started, perhaps an hour or an hour and a half after leaving Milwaukee. The boat generally used the six boilers, but on the way to Milwaukee, he said, the feed-water pipe gasket of one blew out. The pipe was repaired in Milwaukee. The speed of the steamer, he testified, was not increased just before the accident, the throttle not having been touched. He did not know what speed the steamer was making. The engine a few minues before the explosion was making 88 revolutions per minute. He understood it had been run as high as 130 in former seasons, but he had never exceeded 90 revolutions.

Stewart H. Moore, U. S. inspector of steam vessels, said he inspected the "Christopher Columbus" boilers and connections on June 8, and found them in first-class condition. On Sunday he visited the steamer and found a break in both pipe and valve. The steamer was licensed to carry 170 lbs. of steam. The boilers and pipes had been subjected to a hydrostatic test of 255 lbs., and showed no signs of weakness. Owners of boilers have a choice of two valves, and those in the "Christopher Columbus" were equipped with the government spring valve. He thought it practically impossible to tamper with the valves while the boilers were fired up on account of the heat. The inspection after the accident showed the broken metal to be in fairly good condition, considering its long use. The metal was discolored, but he detected no evidence of a flaw. The thickness of the large pipe at its thinnest point was ¾ in., showing the pressure on the pipe was not excessive in view of the amount of metal provided to take the strain.

## THE BISMARCK ALBUM OF THE SOCIETY OF GERMAN ENGINEERS.

On the occasion of the recent celebration by Prince Bismarck of his 80th birthday, the Society of German engineers presented to him a beautiful album, designed to illustrate and symbolize the honor and veneration with which the German industrial world regards the great statesman. The Society is divided into 35 geographical districts, each of which contributed to the album a leaf representing either the chief engineering industry of that particular district, or some famous engineering work in that special section of the country.

We present herewith a half-tone reproduction of the first leaf of the album, which precedes those representing sectional industries already referred to, and sets forth the tribute which the society as a whole pays to the venerable statesman.

The engraving represents a German blacksmith with his wife and child, typifying the German iron and steel industry, on their way, with garlands in their hands, to the celebration of Bismarck's 80th birthday. The female figure above them represents Germany, crowned with oak leaves, and

THE FRONTISPIECE OF THE BISMARCK ALBUM.

overspread by the Imperial eagle. She points to the banner above her head, on which is shown a mounted knight in full armor, standing on guard in the edge of the Saxon forest, and looking out upon a broad plain, across which can be seen in the original the spires of Cologne. The whole is intended to typify the dependence of German industries on the spirit of national unity and national strength, which it has been the work of Bismarck's life to create. The lower right-hand corner of the leaf shows in faint outline the North Sea-Baltic Canal, with the Imperial yacht "Hohenzollern" passing through, and the Levensauer Bridge, the highest structure across the canal, just beyond. The following is a nearly literal translation of the inscription upon the engraving.

August Prince:
Thou that hast fulfilled the ardent longings of our fathers; hast, as a bold and far-seeing engineer, evolved the plans for the erection of the German Empire; hast forged, in the fire of inspiration, the strong bonds of union for the German Tribes, and, by their help, completed the noble structure.

Thee, the true Ekkart* of the German Nation, we, the German engineers, approach to offer thanks that thou hast made the German name respected in all the world; that, with wise art and firm hand, thou hast preserved us peace—peace, under whose protection German industry, made capable of high attainment, has assumed a leading place in the competition of nations.

The Society of German Engineers.

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The Commissioner-General of the Paris Exposition of 1900 has submitted a report embodying and explaining the preliminary plans, or rather locations, for the buildings and grounds. According to the general plan, these buildings will be somewhat widely scattered, though also connected, along the Seine. The aggregate area to be occupied will far exceed that of any previous French exposition, as the exposition will cover the old Champs de Mars, almost solidly, the Trocadero, the Esplanade des Invalides, and include the Palais de l'Industrie and the grounds immediately about it, as far as the Avenue des Champs Elysees. The French military and naval exhibits and foreign exhibits of like nature will occupy the left bank of the Seine and connect the Invalides and the Champs de Mars; and the horticultural exhibits will occupy the other bank, between the two bridges of Alma and the Invalides. A new and wide bridge will be built across the Seine immediately in front of the Esplanade des Invalides. The total estimated expenditure is $20,000,000, divided as follows: For buildings, bridges, grading, superintendence and restoration of grounds after the Exposition, $14,600,000; for mechanical and electrical service, congresses, music, jury of awards, etc., $2,400,000; for personnel, fire protection and general expenses, $1,600,000, and reserve, $1,400,000.

* Ekkart is a term common in German folklore, and signifies the guiding spirit.

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We take pleasure in announcing to our readers that Mr. William Kent becomes, with the present issue, a member of the editorial staff of this journal, and will have special charge of matters pertaining to mechanical and metallurgical engineering. Mr. Kent's extended reputation, both as an engineer, and as an able and lucid writer on engineering topics, is such that he needs little introduction to most of our readers. He graduated from Stevens Institute in 1876, the second class that ever graduated from the full four years' course of that institution, and he is now a member of its Board of Trustees. His engineering experience has covered a variety of fields, and the all-round development thus gained is well attested by the numerous and valuable contributions he has made to technical literature, especially to the proceedings of technical societies. His latest and greatest work, the "Pocketbook for Mechanical Engineers," which has just been published, certainly proves the breadth of his engineering study and experience. Our opinion of this work was set forth in a recent issue (May 16), and need not be repeated here, further than to say that it is to mechanical engineering what Trautwine is to civil engineering, and the two books rank together, we believe, as giving the practicing engineer greater value in proportion to their cost than any other engineering books now on the market.

Mr. Kent has been a member of the American Society of Mechanical Engineers since 1880. He was one of the Managers of the Society from 1885 to 1888, and a Vice-President from 1888 to 1890. He has been a member of the American Institute of Mining Engineers for 19 years, and is also a member of the Engineers' Club of New York City. He is a member of the American Association for the Advancement of Science, and at the Brooklyn meeting last fall was elected a Vice-President and Chairman of the Section of Mechanical Science and Engineering.

Apropos of the illustration by Mr. Wm. R. Webster in our issue of May 2 of the effect of bending steel boiler plate after punching it, we notice in a recent paper read before the Institution of Civil Engineers the statement that in most British boiler shops it is the practice to drill rivet holes, and to do it after the plates have been bent to their final shape. A case was reported in this connection where a Lancashire boiler exploded within six months after being put to work, and it was found that the rivet holes, which had been punched before the plates were bent, had cracks radiating from them. For the benefit of those who still cling to the idea that whatever care may be required with steel, iron will stand any amount of abuse, we may note that this boiler was built of iron.

The paper on "A Piece-Rate System of Paying for Labor," which we print elsewhere in this issue, we consider by all odds the most valuable and important, from every point of view, of the excellent list of papers presented at the Detroit meeting of the American Society of Mechanical Engineers last week. We have an enormous volume of technical literature all the time being poured forth upon tools and machinery of every class, but there is very little indeed in print to aid the engineer in the choice of the best methods of managing the human element in his business on whose efficiency all work must finally depend, and on which, more than anything else, the financial success or failure of an industrial enterprise will not infrequently turn.

While Mr. Taylor's paper is somewhat long, it is so admirably written and expresses so forcibly the important facts with which it deals, that we feel sure every one of our readers who has directly or indirectly to do with the management of men, will be well repaid by its perusal. The plan he presents is no experiment, nor is there anything about it complicated or difficult to understand. In its main feature it amounts to fixing the rate of payment of workmen in a systematic and scientific manner instead of by the haphazard method commonly employed. The other part of the plan, paying an extra high rate of wages for a workman for an extra amount of work, and somewhat less than the current rate for an ordinary amount of work, seems admirably adapted to secure the maximum output from a given establishment.

A curious piece of evidence as to the small basis of knowledge on which the average investor buys securities is furnished by an advertisement in one of our contemporaries, which reads as follows:

> Specialty in negotiating electric and steam railway bonds when payable at A1 trust company in New York, and bonds are printed at an A1 bank-note company in New York.

As the advertiser is in the bond business, he should certainly know what is required in a bond to make it salable, yet one might suppose that a schoolboy in his teens would realize that bank-note companies are merely printers, and do business for whoever will pay their bills. Trust companies, too, are in business to make money. They are not the losers if a company for which they are the trustee of the mortgage defaults on its interest. We hope to see the day come when investors will more generally appreciate the fact that the advice of a competent engineer is the best and safest guide in making investments of this class, and is worth a good price to secure.

The need of state supervision to keep municipalities from polluting or using polluted water supplies is growing more apparent with the increase in population and the diminution of available supplies of potable water. Massachusetts and New York have for some years made their State Boards of Health guardians of the water supplies of their respective states, and it is gratifying to note that a similar plan introduced in Ohio in 1893 seems to be giving good results.

In New York plans for sewerage systems are submitted to the State Board of Health for its approval before construction is begun, and if disapproved the schemes proposed must be modified or abandoned. In addition, the Board may make regulations for the sanitary protection of any public water supply, subject to the approval of the county judge for the county in which the sources of supply are located. In Massachusetts all applications to the legislature for authority to "introduce a system of water supply, drainage or sewerage, shall be accompanied by the recommendation and advice of the said board (State Board of Health) thereon." Besides this, the Board is the general adviser in all changes in old water-supply and sewerage systems, and through thousands of analyses keeps a close watch and makes a careful study of the inland waters of the state. In addition, it expends yearly large sums of money in studies of water and sewage purification.

The Ohio act establishing a State Board of Health was supplemented on March 14, 1893, as follows:

> No city, village, corporation or person shall introduce a public water supply, or system of sewerage, or change or extend any public water supply or outlet of any system of sewerage now in use, unless the proposed source of such water supply or outlet for such sewerage system shall have been submitted to and receive the approval of the State Board of Health.

Since this act went into effect, the "Ohio Sanitary Bulletin" states, the Board has passed upon water-supply schemes for 19 municipalities and had submitted to it plans for or relating to the sewerage of 15 cities and towns. Some of these schemes or plans have been disapproved by the Board in the interest of public health.

The "Bulletin" states that before the passage of the above act a town drawing water from a pure stream was powerless to prevent the pollution of that stream by the sewage of a town above. It seems almost incredible that there shou'd have been no recourse to law in such a case, but even with that possible and practicable, it is not a sufficient safeguard, both because of the slowness and uncertainty of the courts, and the fatal indifference of many communities to sanitary matters. Under existing circumstances, in Ohio all new water and sewerage systems, and all changes in old systems, which lay the people of any community open to the contamination of a water supply, go for approval or disapproval to a body of men constituted for the one purpose of preserving the health and lives of all the inhabitants of the state.

Unfortunately, it seems to an outsider, since the new duties were laid upon the Ohio Board, the sum available for its work, instead of being increased, has been cut down $2,000 a year. The proper performance of the work involved in examining and reporting on water supply and sewerage plans demands the services of an engineer, and often, if not always, of a chemist and a bacteriologist. The New York State Board of Health employs engineers as occasion requires in similar work, and the Massachusetts Board has in its permanent employ an engineer, a chemist, and a bacteriologist who stand in the front rank of their respective professions. In view of these facts it is to be hoped that next year the Ohio Board may be liberally provided with the money necessary to carry on all phases of its work.

## COMMERCIAL EDUCATION IN EUROPE.

A paper which was lately read by Mr. William Layton before the Society of Arts in London has in it points of deep and growing interest to the manufacturers and educators in our own country. The author took as his subject Schools of Commerce, and the best methods of fitting young men to engage in trade and manufacture at home and abroad, with special reference to dealing in the markets of the world. The superiority of the Continental system over English methods in this direction was pointed out, and reasons were given why the European commercial agent was particularly well fitted, as a rule, to do good work in developing international trade. The key to the situation was a thorough education as contrasted with mere instruction, and some details of the Continental methods pursued may be quite as profitable to us as Mr. Layton deemed they would be to his English hearers.

Belgium, in struggling to find employment for her dense population, was the first of European countries to recognize the value of a school especially established for the commercial training of young men. And the "Institut Superieur de Commerce," opened at Antwerp in 1853, was so successful from the start that it ultimately served as a model for similar institutions founded in France, Switzerland, Germany and even in Japan.

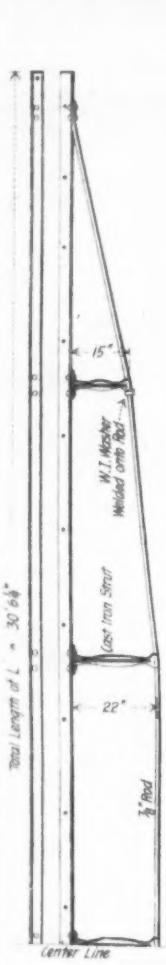
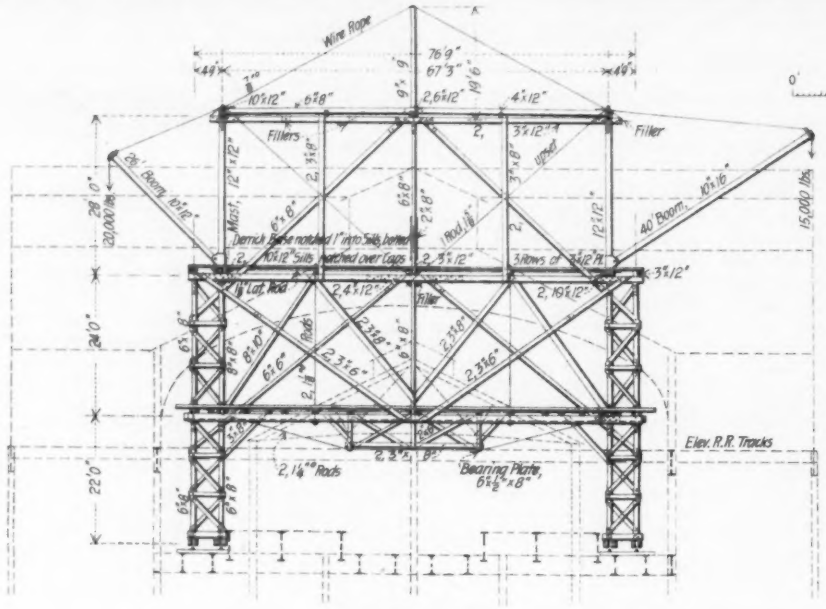
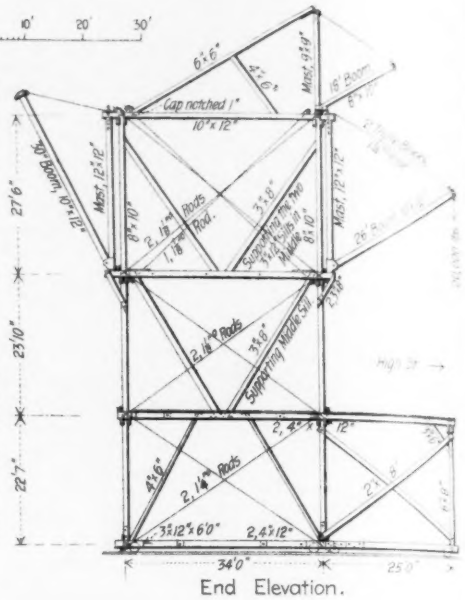



FIG. 7. PURLINS OF WING ROOF.

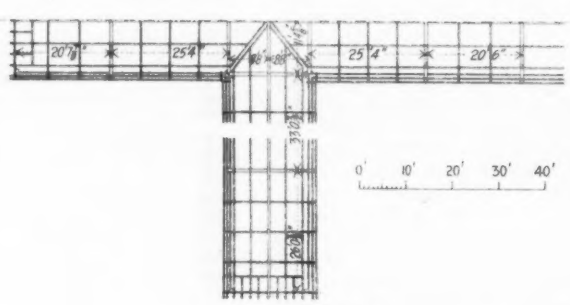



Side Elevation.

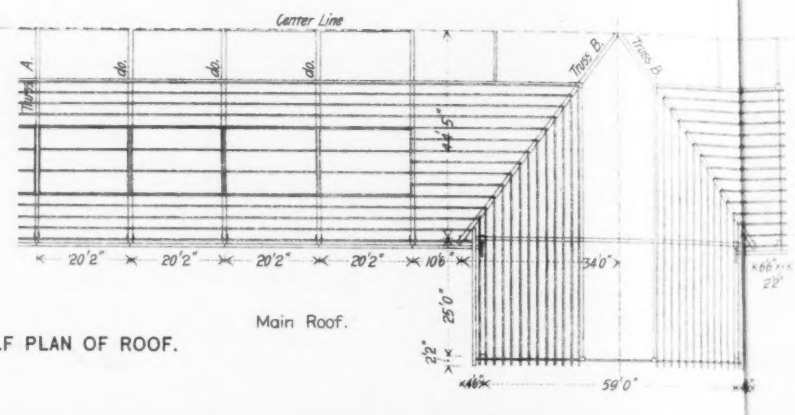
FIG. 10. TRAVELER.




End Elevation.




Clear Story Roof.




Main Roof.

FIG. 4. HALF PLAN OF ROOF.

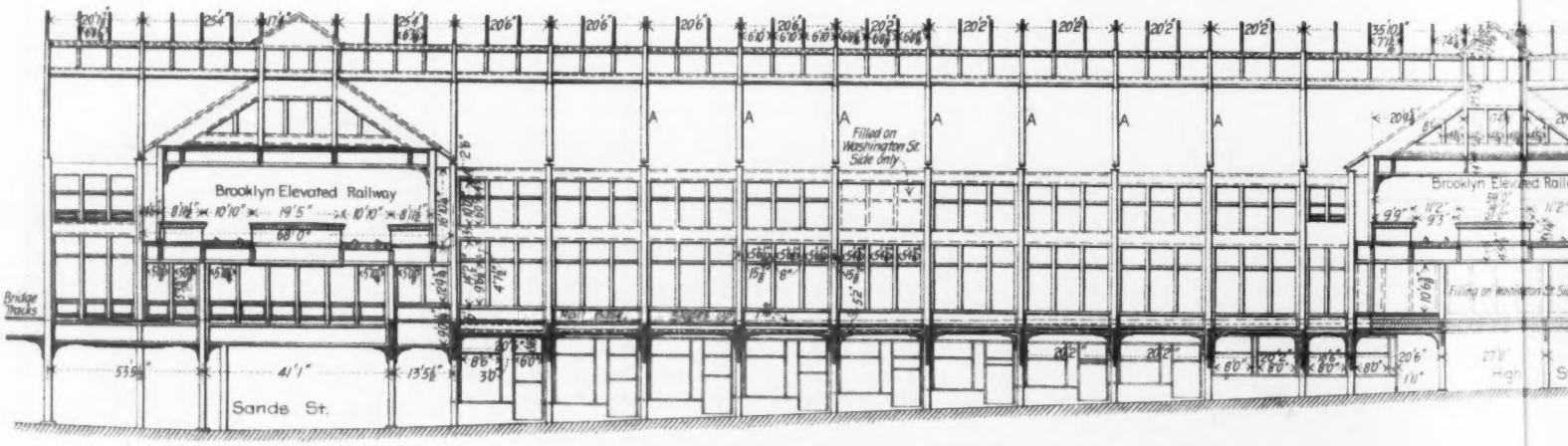



FIG. 1. ELEVATION OF FRAMING OF STATION ON FULTON ST. SIDE.

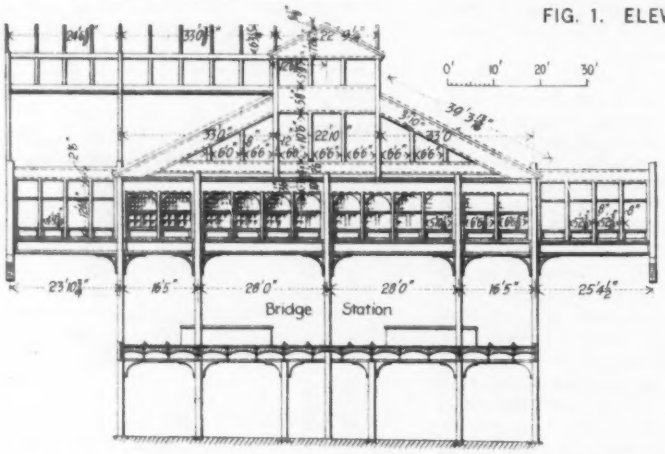
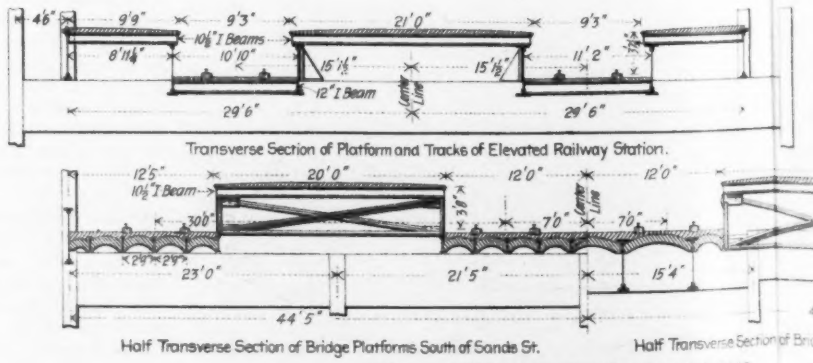



FIG. 2. ELEVATION AND SECTION AT SANDS ST. END OF STATION.




Transverse Section of Platform and Tracks of Elevated Railway Station.

Half Transverse Section of Bridge Platforms South of Sands St.

Half Transverse Section of Bri

FIG. 3. SECTION THROUGH PLATFORMS.

## NEW TERMINAL STATION AT THE BROOKLYN END O

C. C. Martin, M. Am. Soc. C. E., Chief Engineer and Superintendent.

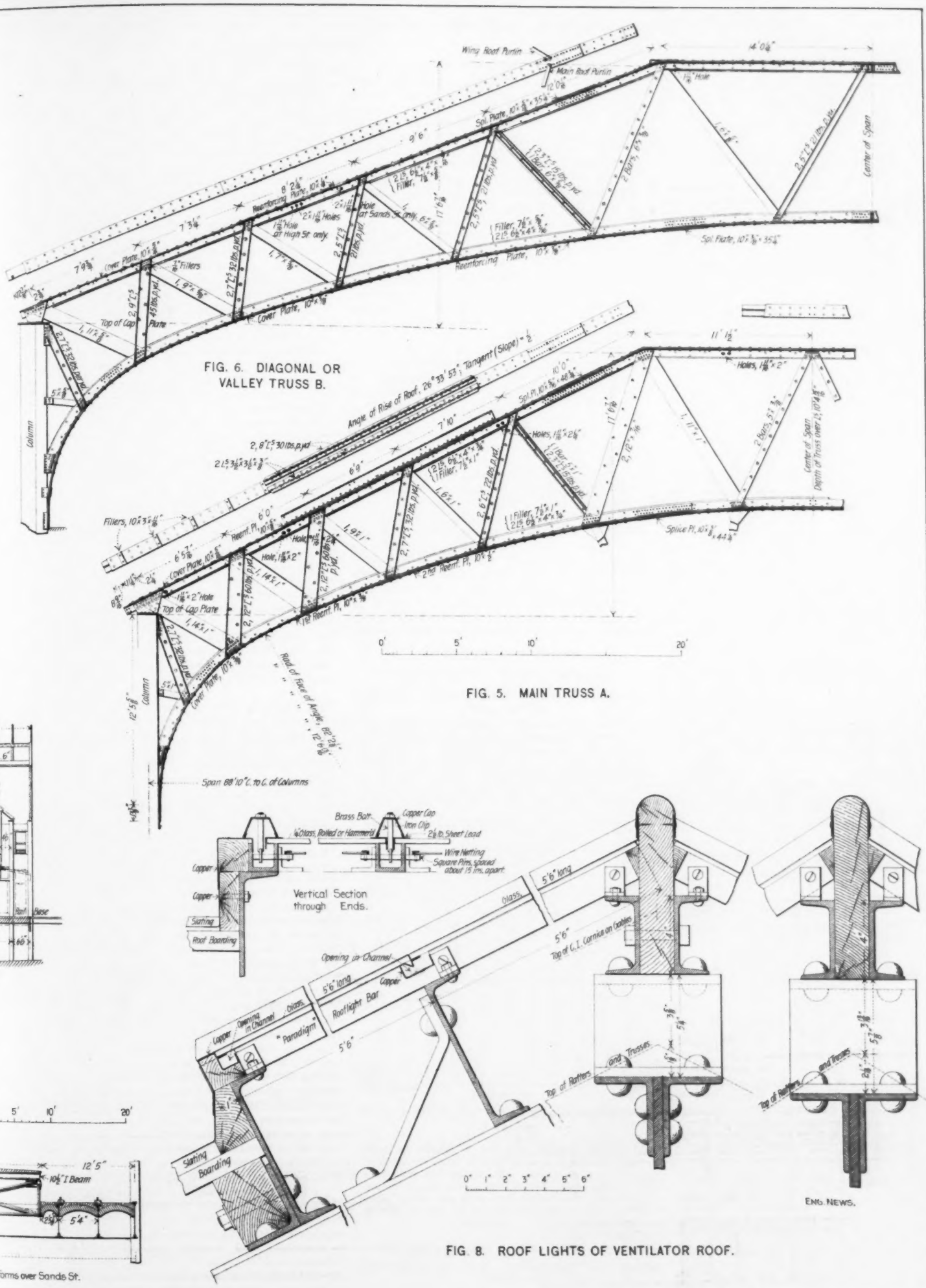
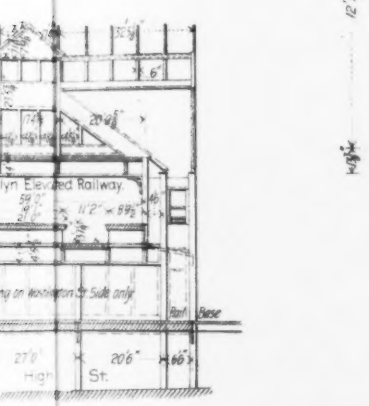
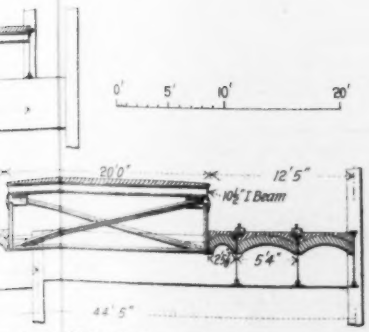



FIG. 6. DIAGONAL OR VALLEY TRUSS B.

FIG. 5. MAIN TRUSS A.




Section of Bridge Platforms over Sands St.

RMS.




FIG. 8. ROOF LIGHTS OF VENTILATOR ROOF.

ENG. NEWS.

END OF THE NEW YORK AND BROOKLYN BRIDGE.

The Phoenix Bridge Co., Contractors.

CHAS. HART & SONS, LITH., 90 VESEY ST., N. Y.

The first difficulty encountered was the general belief that a small amount of education was sufficient for a man destined to be a trader, and pupils were scarce. But the government saw fit to share the expense with the corporation of Antwerp, and the school was started with 51 students of commerce. This number steadily increased, until in 1892 the attendance reached 945, of which 406 were foreigners; on that date also 249 graduates of the school occupied the position of chiefs in the most important mercantile firms of Belgium; 218 were bank managers or commission merchants, and the consular positions of the country were filled with them. It is evident that the Institut has well served the purpose for which it was founded.

Space forbids any detail of the curriculum, but some idea of its scope can be given as follows: Students are divided into two classes, the "regular" and the "free." The first attend all lectures in a prescribed course, with a view of obtaining a diploma at the end of two years; the second class only follow lectures deemed best fitted to advance the student in a selected career. The entrance examination requires a competent knowledge of two foreign languages, and also a like knowledge of single and double-entry bookkeeping, geography, history, natural philosophy, chemistry, geometry, arithmetic and algebra, commercial law and the elements of political economy. In fact, the conditions of entrance are about the same as those demanded for matriculation at the English universities. The "free" student need not pass this examination.

The course of instruction is practical as well as theoretical. The transactions of a large commercial house and the operations of a counting-house are minutely simulated, and the student is obliged to carry on the "office" correspondence in French, German and English. He must also be competent to correspond in one other foreign tongue, generally Spanish, Italian or Dutch. The principles of political economy, of international commercial law and customs regulations are inculcated, and the student is made to especially study foreign markets in reports sent in periodically by Belgian residents abroad.

A well-furnished museum and a proper staff make the student well acquainted with the vegetable, mineral and animal products in which he may be some time called upon to trade, and this department includes as well the geography of foreign countries and their commercial condition, as studied from carefully-compiled data, and the relative value of raw materials from different sources of supply. The student is also encouraged to take a close interest in the political events of the day, as these affect commercial interests; and he studies the latest consular reports from all countries.

Each spring the principal mines, factories, mills, etc., of Belgium are visited by the students and professors, with the view of giving them an insight into the actual working of these establishments, and about $10,000 per year is devoted to traveling scholarships. The student who has passed a creditable examination may enter into competition for one of these scholarships, and if he succeeds he may travel with the certainty of enjoying for three years an annual income of $1,000. He is required to periodically send home a detailed report of the results of his observations, which reports are noted by the government and utilized by the students.

Under the system adopted in Antwerp, the expense to the parent is very small, as the government and the city join in keeping up the establishment. A fee of $50 the first year and $60 the second is contributed by the student, and these are paid out to the professors as a supplement to their regular salaries. A pension is granted by the government to teachers after a certain number of years of service, and the professors themselves maintain a pension fund for widows and orphans.

The study of languages is a strong feature in the Institut. At the end of the two years' course most of the students are familiar with three languages besides their mother tongue. This knowledge of foreign languages gives a graduate a considerable advantage over the trader less accomplished in this direction, and the foreign element among the students at the Institut is of great value in this respect. The student is constantly brought into close contact with fellow students from other lands, and besides acquiring some of their language, they form acquaintances that in after years are not infrequently of considerable commercial benefit. Taey thus also increase their knowledge of men, manners and customs, and this knowledge imparts a certain amount of self-confidence that is of inestimable value in later business transactions.

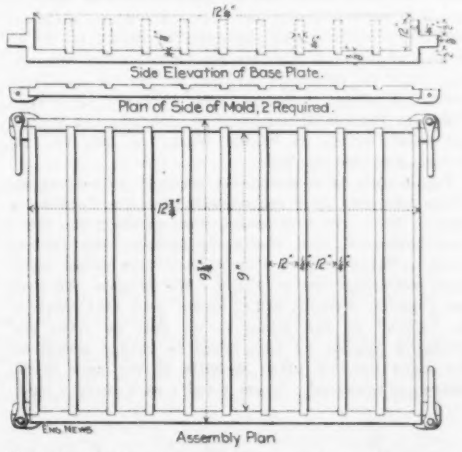
This educational course differs very radically from the methods pursued in the few so-called "business colleges" established in the United States. And while the demand is not yet felt for the thorough linguistic training insisted upon and required in the foreign schools, there is no doubt but that many American young men could successfully broaden their field of effort if they had this capital to aid them. On the other hand, successful trading with foreign nations is as much a subject for close study and thorough training as is any business or profession at home; and the reports of our consuls clearly show how American exporters often fail in competing with the traders of other lands simply from ignorance of the market and its demands. Matters of standards of measurement, ease of transport, adaptability to certain uses or materials of construction, methods of packing and the local taste and wants in foreign markets are all important elements in successful trading, and correct information on these heads is imperative.

Other countries have found profit in the establishment of schools especially fitted for training young men in the very important field of commerce; and though the United States has none, properly so speaking, the time seems near at hand when schools of this character would meet a latent demand, for the simple reason that we already need the men that such schools can alone properly train. To repeat, it is a case of thorough education compared with a mere rudimentary knowledge, and the educated man will generally win in a contest of this kind.

## LETTERS TO THE EDITOR

### MOLDING CEMENT BRIQUETTES FOR TRANSVERSE TESTS.

Sir: Since the subject of transverse tests of cement seems to be attracting considerable attention just at present, I send you herewith, for use, if you desire, a detailed blueprint of the mold which we use for making bars in our testing work. Inasmuch as practice has not yet defined the length of bars within uniformity, we have preferred to make our




Mold for Making Cement Briquettes for Transverse Breaking.

bars as shown, 9 ins. long, largely because this permits of using a 4-in. span to break the bars at the center and permits two other tests, under a good break, of the same bar with the same span. The mold which we have had made under this design weighs 26¼ lbs., is of brass, and cost us $24.

Respectfully, Frank P. Johnson,
City Engineer.

Waltham, Mass., May 4, 1895.

### ROADMAKING AND REPAIRING NI NORTH CAROLINA.

Sir: I have read in your issue of June 13 the letter of a Virginian on the system used in North Carolina for making and repairing dirt roads, though why he should have left his "native heath" to secure the illustration he makes use of is not explained. The roads of North Carolina are certainly as good as those of Virginia, as a whole, and in some of the counties of this state they are not surpassed anywhere in the Union.

If you would go to Charlotte, N. C., for instance, and see the magnificent roads leading out of that city, from 20 to 40 miles in some cases, you would not accept the humorous remarks of Mr. Gleaves as descriptive of the roads, or the methods employed in making and maintaining them, in North Carolina.

In most of the counties the criminals sentenced for less than five years are assigned to work on the public roads of the county in which they are convicted, and in this (Wake) county, and many others, there are from 75 to 100 able-bodied men, and road-making machines, rock crushers and rollers constantly employed on the roads of the county.

Bicyclists from the North have been heard to say that, with the exception of the asphalt roads of Washington city, they have never ridden over such admirable roads as those within a radius of ten miles of Charlotte.

I write these lines because I am not willing that your readers should be misled into believing that North Carolina, which is now undoubtedly the most prosperous of the Southern states, does not maintain a system of "navigable" public roads, as the letter of the Virginia gentleman alluded to would, uncorrected, create that impression. Respectfully,

Maxwell J. Gorman.

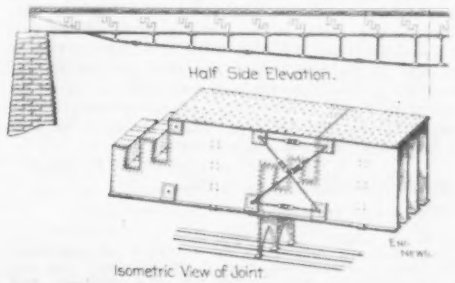
(As we were responsible for the title placed above Mr. Gleaves' letter, it is hardly fair to him to assume, as our correspondent does, that the letter was written to cast discredit on North Carolina highways especially. In fact, if he will read more carefully, he will see that it was the system of road repairing in general use in the South to which Mr. Gleaves desired to call attention. For that matter, until the movement for better highways brought about some changes, the custom of working out the road tax, to which Mr. Gleaves alludes, was probably quite as common in the North as in the South.—Ed.)

### RESPECTFULLY SUBMITTED TO THE NEW YORK & NEW JERSEY BRIDGE CO.

Sir: Under another cover I send you a photograph of a new patent bridge, which I recently received, together with a letter from its inventor. I think it may be of some interest to the engineers who are wrestling with the problem of spanning Hudson River, Behring Strait, the British Channel and other broad bodies of water, that is, if the inventor can back up his modest claims. Yours very truly, F. C. H. Arents.

Lafayette, Ind., May 6, 1895.

(We reproduce part of the photograph herewith. The inventor states that he has made this sketch for 1,000 ft. span, but his truss "has no special




length of span. It can be made any required length." The letter of the inventor enclosed was, verbatim, as follows:

Dear Sir: Your letter of the 4th inst. at hand. I am not an engineer or a bridge builder, I do not know the amount of steel that it would take to build a clear span of 300, 400 or 500 ft. It is reasonable, in my mind, that the longer the span is made over a given length, the weaker it will become, when built of the plate girder, a riveted lattice girder and the pin-connected truss. That will not be the case with this girder truss bridge. The same size girder will answer for the 300, 400 or 500 ft., but the size of wire cable must be increased according to length of span. It is not the great amount of steel and the great size of girder that give this bridge its strength; it is the dovetails and the steel cables. According to the amount of strength required in bridge, increase the amount of cables from two to four under each girder, the laps of dovetails from 4 ft. to 6 ft., and the length of solid beam between laps from 10 to 15 ft., according to number of eye-beams in girder. This truss bridge can be built a mile long if required. It can be made as strong at the distance of one mile as it can be at 200 ft. The dovetails and steel rope give it the strength required.

This truss bridge can be set together without any falsework of any description. This is more than can

be done with any other kind of a bridge, except suspension. I claim that this truss bridge is cheaper by one-half the cost than any other bridge made, and I claim that it has double the strength of any other bridge made of equal length of span and using only one half the amount of material.

In the early days of railway bridge building in this country, it used to be said that certain builders of Howe truss bridges built them by the mile and cut them up in lengths to suit the stream to be spanned. The inventor of the above curiosity seems to be working on the same idea. The meritorious feature of the design is that there seems to be very small chance that any of the structure will ever be actually erected, to afterward fall down, as other "patent" bridges have done. In view of its excellence in this particular, other trifling faults in the invention may well be passed over in silence.—Ed.)

## LENGTH OF HALF-MILE TROTTING TRACKS.

Sir: In reply to Mr. E. P. Augur's communication in your issue of May 30 relative to dimensions of a regulation trotting course, I would say that the dimensions as given by me in my contribution on the subject are those adopted and used by Mr. G. M. Delany, of Burlington, Vt., a practical racetrack builder, who has built a large number of practical and successful tracks in New England and elsewhere.

The dimensions given by me will locate the inner fence or pole line, while the half-mile distance will be measured 3 ft. from this. The computed distance will foot up a scant half-mile, but if the track be measured, the total distance will generally exceed the required amount by some inches. This results from the slight irregularity in setting the posts on the curves for the pole line. It is best to make the diameter of the semi-circles about .05 ft. longer than the dimensions quoted, to insure a slight excess over the half-mile. An excess of not more than 2 ft. is permissible. Very truly yours, C. H. Schumann,

265 Broadway, New York, June 3, 1895.

Sir: I have received the enclosed letter from Mr. Wilkes, of New Rochelle, the Engineer in Charge of the sewerage improvements in that place, with whom I am personally acquainted.

I think there is great need of more reliable information concerning regulation dimensions for trotting courses. I question somewhat whether the relative proportions between curves and straight sides have been absolutely fixed by any association. The "regulation" perhaps applies to the line upon which the half-mile is to be measured.

Mr. Wilkes' tangents are longer even, and his curves are of shorter radius, than mine. I have inquired, since I sent you the communication published in your issue of May 30, of Mr. George H. Bishop, who laid out one or two such courses many years ago, what he considered the proper dimensions, and he stated, as I have stated in my communication—tangents and curves of equal length, 660 ft., on a line 3 ft. outside the inner edge of the track. I am sure I had a similar opinion from another engineer several years ago, when I was about to lay out the first of the four tracks I have laid out. If there is a definite rule as to these proportions, which has been adopted by any association, which would give authority in its so deciding, it would be of value to your readers if you can make that fact known. There seems to be need of more light on this subject, evidently.

Yours truly, E. P. Augur.

Middletown, Conn., June 1, 1895.

(The letter enclosed is as follows.—Ed.)

Mr. E. P. Augur.

Dear Sir: In regard to the standard or regulation racetrack, I would say that I "remodeled" the one at the Danbury Agricultural Society's grounds, and have since laid out three others, all of which I had supposed to be regulation tracks. My half-mile line consisted of two parallel tangents 697.5 ft. long, united at the ends with semi-circular curves of 198.1 ft. radius, the fence or "pole" being 3 ft. inside the above-described line. The transverse slopes were the same as you state in the Engineering News.

My authority for the above being standard tracks was Mr. John W. Bacon, a member of the Connecticut Society of Civil Engineers and Surveyors, and a prominent official of the Danbury Agricultural Society, who told me that the track at the Agricultural Society's grounds was laid out by Mr. George W. Avery, and was a standard track.

I also laid out the track at the Ridgewood Stock Farm (where they are certainly very particular about those things), and was afterwards informed that the track was perfectly correct and satisfactory in all respects.

I do not profess to know just what a standard track should be, but simply give the benefit of my experience. Yours truly, J. K. Wilkes.

New Rochelle, N. Y., May 30, 1895.

Sir: A correspondent has recently asked in your columns the dimensions of "regulation" racetracks. There seems to be a general understanding, without written dictum, that a "regulation" mile track is made up of two semi-circles and two tangents, each 1,320 ft. long; and that "regulation" half-mile tracks, or those of other lengths, are similar figures, with parts in exact proportion to those of the mile track. The radius of a 1,320-ft. semi-circle is 420.169 ft., hence the radius of a half-mile track is 210.085 ft. Whatever the length or shape of a track, its distance line is 3 ft. from the inside fence line and parallel to it, and the fence lines are those actually staked out in field work. Transition curves would be quite as advantageous as on railways. The writer has staked out one mile track, two half-mile tracks and a one-third-mile track, all called "regulation" tracks, and proportioned as stated above; the details for one of these are given in a paper recently published by the Engineering Association of the South.

Walter G. Kirkpatrick.

Nashville, Tenn., June 6, 1895.

(As so much interest seems to be felt in this question, we addressed an inquiry to the editor of the "Spirit of the Times," the principal publication devoted to trotting interests, and received a reply stating that no standard half-mile track had ever been adopted by any association. An article published in the "Spirit of the Times" for Dec. 24, 1887, describes the building of racetracks and defines the half-mile track as two tangents each 660 ft. long, connected by two semi-circles, each 660 ft. long. The fence is to be set 3 ft. inside the line on which the distance is measured. The editor of the "Spirit of the Times" informs us that half-mile tracks are usually built in conformity to these dimensions. In Engineering News of Oct. 11, 1890, an article was published giving illustrations of the half-mile track above described, and also of the kite-shaped track.—Ed.)

## MECHANICS OF THE FERRIS WHEEL (WITH STIFF SPOKES).

Sir: As the interdependence between the stresses in the bars of a Ferris wheel (with stiff spokes) and their elastic changes of length has been but lightly touched upon in your columns up to this date, the following discussion may prove of interest to those who have not already applied a method for themselves.

Since a Ferris wheel with spokes capable of resisting compression as well as tension manifestly belongs to the class of frames having redundant members (since any one bar could be omitted without collapse), the stresses in the members under any loading are dependent on the dimensions (both as to section and length) and on the elasticity of the members themselves. To bring out the essential nature of this dependence, let us treat a case where not all the spokes are necessarily alike, nor all the segments of the rim; nor all the loads equal; and yet a case where sufficient symmetry of form and regularity of design (as to dimensions and elasticity) are retained to avoid complexity. (For the principles involved in treating structures with redundant members, see Professor Johnson's "Modern Framed Structures," pp. 220-230; and Professor Cain's article on "Least Work," p. 265, Vol. 24, Trans. Am. Soc. C. E.)

Fig. 1 (full lines) shows the "wheel" to be treated. There are only four segments in the rim, forming a square, while the four spokes (two vertical; the other two horizontal) are the half-diagonals; the central joint, o, being supported on a shaft with proper bearings; pin-connection at joints. We suppose the bars put together without initial stress and that there is no "slack" at the joints (i. e., that as loads are gradually applied all bars begin to change length at the same instant). The weights of the bars themselves are neglected. Joints a and c each carry a load, W, but joints e and e a load, W', different from W. Bars with the same number affixed are alike in every respect (equal lengths, equal sectional areas, and equal moduli of elasticity). It is seen, therefore, that the design of the frame, both as to size and elasticity of the bars, is made symmetrical about the vertical line ac. It is assumed, also, that the elastic limit is not passed in any bar. Let the sectional areas, lengths, and moduli of elasticity of the bars be denoted respectively by F, L, and E, the (total) stress in each by P, and the corresponding elongation (or shortening) by l; all with proper subscripts, referring to the different bars. We have, therefore, from a well-known relation in mechanics of materials,

$$l_1 = \frac{P_1 L_1}{F_1 E_1}; \quad l_2 = \frac{P_2 L_2}{F_2 E_2}, \text{ etc., to } l_5 = \frac{P_5 L_5}{F_5 E_5}.$$

For brevity denote $\frac{L_1}{F_1 E_1}$ by $C_1$; $\frac{L_2}{F_2 E_2}$ by $C_2$, etc.; and we now have $l_1 = C_1 P_1$; $l_2 = C_2 P_2$; $l_3 = C_3 P_3$, etc. (1)

The P's and the l's are as yet unknown. If now we assume that $P_1$ is a thrust and greater than W and take a convenient value for it, a stress-diagram can be drawn for the three joints, a, e (on left), and c (see Fig. 5), this being done simply to enable us to express all the other stresses in terms of the unknown $P_1$ and the known W' and W. The force-polygons for these joints are, respectively, A, E, and C. From the trigonometry of the diagram, it follows that

$$P_2 = \frac{\sqrt{2}}{2}(P_1 - W); \qquad P_3 = P_1 - W - W';$$

$$P_4 = \frac{\sqrt{2}}{2}(W + 2W' - P_1); \text{ and } P_5 = 2W + 2W' - P_1.$$

Since the deflection of the joint c is in this case identical with the elongation of bar 5, we can determine the true value of $P_1$ by writing $l_5$ equal to the sum of the respective changes of length that would be produced in bar 5, if that bar and each other bar (or each pair of corresponding bars, with the same number) were, in turn, the only elastic bars; thus: From Fig. 1 we see that if bar 1 shortens by an amount, ab, while all other bars except 5 remain unchanged in length, bar 5 will elongate an amount cd, = ab, = $l_1$, the dotted lines showing the resulting new positions of all the bars. If only bars 2 and bar 5 (Fig. 2) change length, bars 2 each elongating an amount rg = $l_2$, bar 5 will stretch an amount ch, = $l_2\sqrt{2}$. If bars 3 and bar 5 alone change length (Fig. 3), bars 3 being each shortened by an amount = ep, = $l_3$, bar 5 will be lengthened by an amount = cm, = 2 $l_3$. And finally (Fig. 4), if only bars 4 and 5 are altered in length, and bar 4 shortens an amount qn, = $l_4$, bar 5 will shorten an amount cn, = $l_4\sqrt{2}$. (The various bars have been assumed as lengthening, or shortening, to correspond with the character of the stress as indicated in Fig. 5. Should any of the l's prove to be of a different sign from that assumed, the corresponding stress, P, would also be of different sign, and the final result would not be affected.)

Writing, therefore, the actual elongation, $l_5$, of bar 5, equal to the sum of its partial elongations, as due to the changes of form of the other bars, we have

$$l_5 = l_1 + \sqrt{2}\,l_2 + 2\,l_3 - \sqrt{2}\,l_4. \qquad (2)$$

Substituting $C_1 P_1$ for $l_1$, $C_2 P_2$ for $l_2$, etc., in eq. (2), writing $P_2$, $P_3$, etc., in terms of $P_1$, and solving for $P_1$, we have finally,

$$P_1 = \frac{(C_3 + 2C_2 + C_4 + 2C_5)W + (2C_3 + 2C_4 + 2C_5)W'}{C_1 + C_3 + 2C_2 + C_4 + C_5}$$

from which all the other P's can now be found.

If the spokes are all alike, $C_1 = C_3 = C_5$; and if, also, all the segments of the rim are to have the same sectional area and are of the same material, $C_2 = C_4$; and $P_1$ reduces to W + W'.

Furthermore, if W = W', $P_1$ becomes 2 W, as we know from previous contributions to Engineering News (see references below).

It may also be of interest to call attention to the fact that the sum of the series (occurring on p. 234, Eng. News of March 22, 1894, and also on p. 72 of Professor Johnson's "Framed Structures")

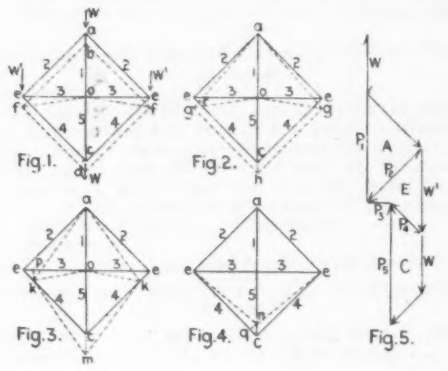
$$\sin a + \sin 2a + \sin 3a + \ldots + \sin n$$

$$\text{is} = \frac{\sin\frac{n+1}{2} \quad \sin\frac{n}{2}}{\sin\frac{a}{2}}$$

(see p. 296 Todhunter and Hogg's Trigonometry).

Sincerely yours, I. P. Church.

Ithaca, N. Y., May 10, 1895.



## THE MEANING OF ELASTIC LIMIT IN STEEL SPECIFICATIONS.

Sir: The statement which I made in your issue of April 18, that when the term "elastic limit" was used in a specification without qualification, it was generally meant and accepted to apply to the scale beam elastic limit, is the result of several years' personal observation in the steel mills of this country.

I have seen all kinds of steel in general use tested by many different inspectors working under the principal current specifications of the day, and in no instance have I seen the elastic limit taken in any other manner than by the scale beam drop, in the course of ordinary inspection.

What may have been meant by those who framed the specifications, I do not know; but it is apparent that the manufacturer and inspector translated the elastic limit to mean the scale beam drop, and the tacit acquiescence of the engineer for years has fixed the matter.

An apparatus for determining the true elastic limit is not a part of an inspector's outfit, neither is one furnished by the mill, and if an attempt were made to reject any large quantity of material by the use of such an apparatus, the question would, doubtless, be settled in a court of law.

I am aware that the scale beam elastic limit is a function of the speed of the testing machine, having demonstrated the same, as will be seen by reference to Table I., herewith. Knowing that the scale beam elastic limit is a function of the speed, I do not permit any unusual proceeding in taking it. I have recently been inspecting a large amount of material under "Cooper's Specification" for soft steel, which is as follows:

Ultimate strength, 54,000 to 62,000 lbs. Elastic limit, not less than 30,000 lbs. Elongation in 8 ins., not less than 25%. Reduction of area, not required.

It will be seen that in this specification the elastic percentage for the lower ultimate is about 55.6%, and for the higher ultimate only about 48.4%. Consequently no precautions whatever are necessary to get the required elastic limit. In Table II. are given the average results of 54 tests, each made on a different heat of steel, and also the test having the lowest elastic limit and the one having the highest. The elastic limit percentage for the average is about 61.7%; for the lowest about 58%, and for the highest about 78.5%.

These tests were made on an ordinary machine, in the ordinary manner, and at a mill that has no reputation to make for its own steel, as it manufactures none, but buys in the open market.

While the elastic limit is one of the most important functions of the steel itself, it is one of the least important points in a specification, and may with safety be omitted altogether—in fact, often is. Of far more importance in a specification are the kind of steel, its chemistry, and, not infrequently, its reduction of area.

In your issue of April 25 appears a "modern specification" by Mr. Harry J. Lewis, of Pittsburg, accompanied by an excellent set of notes, in which the above matters are given due prominence.

In mentioning "reduction of area" I have touched upon another much disputed point, and I can best illustrate its value by citing an instance that came under my personal observation. A lot of eyebar flats made under a strict specification had passed the specimen test "by a hair," in every particular except the reduction of area; repeated tests failed to give anywhere near the required reduction, and the bars were put "in scrap" as unfit for use; about this time a hurried order for a few bars of the same section was received, and as they were under a specification that required no reduction of area, and the rejected bars passed the other requirements, enough of them to fill the order were taken out of the scrap and shipped.

Some of the recent specifications which have been issued, although based upon results previously obtained, have brought forth a storm of criticism upon every one connected with them in any way, and while they may never be generally adopted, they mark a turning point in this line the value of which will be appreciated at no distant date. Yours truly,

A. C. Cunningham, M. Am. Soc. C. E.

Wayne, Pa., May 2, 1895.

TABLE I.—Averages of Three Groups of Five Tests Each, Cut from Uniform Material, ¾ in. Diameter, and Tested at Different Speeds on the Same Machine.

| Group. | Elastic limit, speed per min. | Ult. speed per min. | Elastic limit. | Ult. strength. | Elongation in 8 ins. | Red. of area. |
|---|---|---|---|---|---|---|
| | ins. | ins. | lbs. | lbs | % | % |
| 1 | ¼ | 15-16 | 40,620 | 61,360 | 30.6 | 58.0 |
| 2 | 15-16 | 2¾ | 44,450 | 62,550 | 30.1 | 54.4 |
| 3 | ¼ | 3 11-16 | 41,200 | 62,180 | 30.7 | 56.5 |

TABLE II.—Average Results of Tests on 54 Different Heats of Steel, Showing Varying Ratios Between Elastic Limit and Ultimate Strength.

| Thickness of test piece. | Elastic limit. | Ult. strength. | Elongation in 8 ins. | Red. of area. | Elastic limit. | |
|---|---|---|---|---|---|---|
| ins. | lbs. | lbs. | % | % | % | |
| ¼ to 1 | 36,200 | 58,640 | 28.8 | 57.9 | 61.7 | Av. of 54 tests. |
| ¾ | 32,550 | 56,140 | 30.5 | 57.3 | 58.0 | Lowest elastic. |
| 5-16 | 47,080 | 60,000 | 25.0 | 55.9 | 78.5 | Highest elastic. |

Sir: When Mr. George Thomson's new specifications were issued they were referred to me by the Pottstown Iron Co. I examined them carefully and made a series of tests on acid open-hearth steel, and on the results of these tests advised the company not to bid on any material subject to these specifications, as the elastic limit of 38,000 lbs. was too high on a steel of 58,000 to 65,000 lbs. ultimate strength, and 26% stretch in 8 ins. I also suggested that either the elastic limit or per cent. of elongation would have to be modified. From that time on I have closely watched the working of these specifications with the following results:

(1) I heard of the elastic limit being modified to 34,000 lbs., or about six-tenths of the low limit of ultimate strength.

(2) Mr. Cunningham, in list of tests published in the "Iron Age" of Jan. 3, 1895, showed that 34,050 lbs. elastic limit would not be cause for rejection of the material.*

(3) The specifications of the American Engineering & Inspection Association were issued after these gentlemen had inspected several thousand tons of material under Mr. Thomson's specifications, and they called for an elastic limit of only one-half the ultimate strength.

I admit that, up to this point, it was only a business transaction between the mills and the engineer, but when on Feb. 28 the results of 71 tests were published in most of our engineering journals, and claims made that it was an easy matter to get this material, and that it was only the unreasonable steel makers who had objected, it became a very different matter.

After waiting several weeks for some one to take the matter up, I asked the superintendent of one of our largest steel works if he would accept an order subject to Mr. Thomson's specifications, provided that the elastic limit should be taken by the extension of the test piece for each increase of 1,000 lbs. in the load (the ordinary method used at Watertown). He replied: "No, we would insist on taking the elastic limit by the drop of the beam and in our own usual method"; in other words, he would "only bet on his own game."

The above is what led me to write the letter which appeared in Engineering News of April 18, in which I quoted largely from the specifications of the American Engineering & Inspection Association, as I consider them in some respects the best that have ever been issued. I also asked their (the above association's) views as to the true elastic limit of this material, as it was current rumor that the article in your issue of Feb. 28 was from these gentlemen, and it differed so widely from their views, as given in their specifications, that I wanted more light on the subject.

I thank Messrs. Stowell and Cunningham for their full and complete answers to my letter in your issue of April 18, but before replying to them will give a few points on this important matter.

In 1878, when I first started to inspect material, nearly all the testing machines were operated by hand power, and in taking the elastic limit we used a pair of dividers set with points about 8 ins. apart. One end being placed in a center punch mark, chalk was rubbed on the specimen and a line marked on it with the other end of the dividers. A load of about 20,000 lbs. per sq. in. was then applied on the specimen, the operator with the dividers carefully watching for any stretch of the test piece. If no stretch was observed, a higher load was applied, and when any stretch was observed, the whole load was taken off the test piece in order to see if any permanent set had taken place.

The next step was to rely on the stretch, as shown by the dividers when the load is on, in order to save the time of running back. It was also observed that the man operating the pump, or turning the hand-wheel on the screw machines, could tell when the elastic limit was reached by the additional number of strokes of his pump lever, or turns of the hand-wheel, required to bring the beam up for the same increase of load. In all these cases the beam would drop when the elastic limit was reached. When steel was tested by these methods, there was a much more decided drop of the beam. Gradually the method of taking the elastic limit by the drop of the beam, checked by use of the dividers, came into general use. Some observers also used the cracking of the scale on the rolled surface of steel as a check on the drop of the beam. It has been shown that the elastic limit taken by the above methods agrees very closely with that obtained when the stretch is measured for small increments of load, by using delicate extensimeters and electrical contact.

When the modern testing machines, driven by steam power, came into use they were operated at very slow speed and elastic limits taken by the drop of the beam, but in all cases the dividers were used as a check by the old operators who had used the hand machines. The results obtained in this way could be relied upon and agreed closely with the true elastic limit of the material. But the number of tests required to be made in a day on one machine have been increased five or six times, and as a natural consequence much faster speeds are used in order to get out the work. Gradually a new set of men were put on to operate the machines. They had never heard of running the machine back to see if any permanent set had taken place in the test piece, and were instructed only in taking it by the drop of the beam, and to regulate the speed of the machine in a manner best suited to meet the sometimes unreasonable requirements on this point. They are now called upon to make from 20 to 30 and even 40 tests per hour, and they do it. One man puts down the measurements and figures out the results for the manufacturer, another measures the test pieces and puts them in the machine, and runs it. If the machine has an automatic arrangement for applying the load on the beam, this man has a little spare time, but if he has to run out the weights on the beam he is kept busy all the time. The inspector generally has all he can attend to in putting down his measurements and using the slide rule. No one is provided to check the drop of the beam in taking the elastic limit by use of dividers or any other simple method, and as a result often it is not checked. I know of cases in which the test piece had stretched 3-10 in. at the elastic limit reported. In other words, by the present methods in use no reliance whatever can be placed on the elastic limits reported.

Mr. Harry J. Lewis, in his article on soft steel for bridges, before the Engineer's Society of Western Pennsylvania, and given in your paper of April 25, states that in his specifications:

The elastic limit has been placed at one-half the ultimate strength, which is somewhat low, in order to remove, as far as possible, any incentive to cold rolling, and this has not been found to result in any lowering of the quality of the material. The different ways of obtaining the elastic limit in the various mills make this the most uncertain of all the observed properties of the material, and it is, therefore, hardly advisable to make the requirements regarding it too rigid, except in special cases, when the mode of taking the observation should be definitely prescribed.

Mr. Cunningham, in his reply to my letter (Eng. News, April 18), states:

The term elastic limit, unless qualified, is a trade nomenclature meaning the drop of the scale beam in the testing machine. The term had this meaning when I inherited it from my predecessors.

It is very unfortunate that Mr. Cunningham did not also receive with this inheritance a statement of the conditions under which tests were made by his predecessors, and how they checked the elastic limit by use of the dividers. I can only say that the elastic limits we reported were as close to the true elastic limits as we could get with the means at our disposal. In this connection I would ask Mr. Cunningham if he or his representative checked by use of the dividers the elastic limits reported in the 71 tests referred to in Engineering News of Feb. 28. I should judge that no such check was used, since Mr. Stowell frankly admits in his letter (Eng. News, April 18) that he does not know how the elastic limits reported in these tests would agree with the true elastic limits of the material, if taken by the method used at Watertown, of course smaller increments of load than 1,000 lbs. being used.

The only material that I referred to in any way in my former letter was material subject to Mr. Thom-

*Mr. Cunningham's statement was as follows:

"Interesting and instructive cases are found in the reports numbered 4, 6 and 12, in which failures to comply with the physical requirements will be found. In the first two, the low elastic limit and ultimate strength may be directly attributed to the low percentage of phosphorus, but as the other properties of the steel were in excess of the requirements, and the quality was superior to that required chemically, it was decided to accept the material."

Cases referred to by Mr. Cunningham:

| | Elastic limit, lbs. | Ultimate strength, lbs. |
|---|---|---|
| No. 4 | 34,050 | 55,820 |
| " | 35,940 | 56,960 |
| No. 6 | 36,470 | 56,100 |
| " | 36,410 | 56,500 |
| " | 36,100 | 57,310 |
| No. 3 | 34,800 | 57,080 |
| " | 38,000 | 58,810 |
| No. 5 | 35,680 | 59,130 |
| " | 36,530 | 59,540 |
| No. 7 | 36,410 | 56,020 |
| " | 39,360 | 58,460 |

son's specifications, and the modifications referred to are the instructions that Messrs. Cunningham and Stowell have received—i. e., to accept material with elastic limit down to 34,000 lbs. per sq. in.

My only object is to show that we are having results that are not reliable forced upon us through this and other journals, and it is the duty of every engineer when he knows such to be the case to call attention to it. I have not made these statements without first having thoroughly tested material which was reported by its manufacturer to have met the requirements of Mr. Thomson's specifications and base my assertions on the results obtained.

It would be of great interest to have the views of some of Mr. Cunningham's predecessors on what they reported as the elastic limit of iron and steel.

As this matter is also of great importance to the steel makers, some of them may also be induced to give their views on this subject of exceedingly high elastic limits and "go-as-you-please methods of testing."

I have not referred to the extensimeters used when more accurate work is required, as they are well known to all. Yours truly,

Wm. R. Webster.

3310 Hamilton St., Philadelphia, April 29, 1895.

(As a direct question is asked of Mr. Cunningham in the above letter, we submitted a proof to him, and append his reply as follows:—Ed.)

Sir: The above very interesting and complete description by Mr. Webster of how testing was done in 1878 is a valuable addition to the history of this subject. In 1887, at one of the prominent mills of Pittsburg, the hand wheel was still used for producing the slow motion which determined the elastic limit, and continued to be used for some time thereafter. When increasing requirements caused this mill to purchase a modern testing machine, in which the slow elastic limit motion was produced by power instead of by hand, the old and new machines were used alongside of

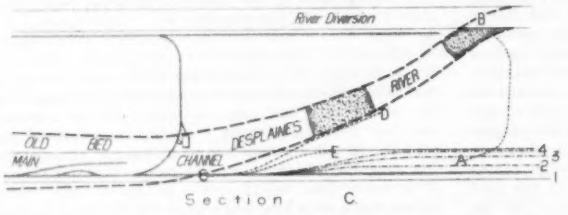



FIG. 28. PLAN OF TRACK SYSTEM SHOWING METHOD OF EXCAVATION ON SECTION C.

by the older methods were as near the true elastic limits as could be obtained might have safely included also that they were as high as could then be obtained.

I should be as well pleased as Mr. Webster if our manufacturers would give us their opinion of "go-as-you-please" testing, and at the same time an opinion of "commercial inspection," which has done much to foster this kind of testing. Regarding Mr. Webster's statements: He has been wrongly informed about Mr. Geo. H. Thomson having modified his elastic limit to 34,000 lbs. in his specification. His statement that Messrs. Cunningham and Stowell have been instructed by Mr. Thomson to accept material as low in elastic limit as 34,000 lbs. is also, unfortunately, in error. We have received instructions to use our judgment about accepting material which differed slightly from specified requirements, or in cases which we deemed worthy of consideration to refer the same to Mr. Thomson. The reports partially reproduced by Mr. Webster come under these heads.

I cannot understand why the Pottstown Iron Co. should refer Mr. Thomson's specification to Mr. Webster with a view to bidding on material made under them. The specification definitely calls for acid open-hearth steel, and farther requires that the steel shall be made by the same mill that rolls it; these conditions, I think, effectually bar the Pottstown Iron Co., and suggestions for modifications would hardly be in each other for a considerable time, without any noticeable difference in the elastic limits being observed.

In Pittsburg and vicinity at this same time there were several testing machines so sluggish and inert that it was only by the use of the dividers that any elastic limit could be determined. The use of the dividers is not yet obsolete—in fact, they are used in almost every testing room to check doubtful cases, and hand wheels and pumps on testing machines may still be found.

I do not think we have forgotten or lost anything that was of value in the older methods of testing; increased accuracy and sensitiveness in modern testing machines, as well as cumulative experience, has, however, rendered some of the former practices unnecessary. The statement that the elastic limits obtained of test piece, would naturally give a lower elastic than the same material rolled into plates and angles, which are finished at a lower temperature, receive a greater percentage of work, and are not annealed. With all the conditions being against the development of the highest elastic limit of this material, an elastic percentage will be found that some engineers consider impossible, even in a specimen test. Yours truly,

A. C. Cunningham.

Wayne, Pa., May 16, 1895.

Ratio of Elastic Limit to Ultimate Strength in 13 Samples of Full-Sized Bars of Acid Open-Hearth Steel.

| Size of test bar, ins. | Elastic limit per sq. in., lbs. | Ultimate strength per sq. in., lbs. | Elastic ratio, per cent. |
|---|---|---|---|
| 8 × 1⅜ | 30,270 | 52,110 | 58.0 |
| 8 × 1 7-16 | 33,630 | 58,850 | 57.1 |
| 8 × 1⅜ | 32,740 | 54,480 | 60.0 |
| 8 × 1 | 35,030 | 57,490 | 60.9 |
| 10 × 1⅛ | 33,090 | 58,180 | 56.8 |
| 8 × 15-16 | 35,220 | 58,010 | 60.7 |
| 10 × 1 13-16 | 33,030 | 59,290 | 56.8 |
| 10 × 1½ | 30,000 | 53,200 | 56.7 |
| 8 × 15-16 | 35,920 | 58,020 | 61.8 |
| 8 × 1⅛ | 37,740 | 66,110 | 57.0 |
| 10 × 1⅛ | 36,030 | 61,390 | 58.6 |
| 10 × 1⅜ | 34,610 | 56,890 | 60.8 |
| 10 × 1½ | 32,200 | 55,040 | 58.5 |

A large rock-crushing plant has been built on Mt. Tom, near Holyoke, Mass., by Mr. Geo. S. Colton. The debris resulting from the weathering of the basalt cliffs on the mountain is so fine that it can be shoveled up and dumped directly into the crusher without preliminary blasting or breaking. A cable incline railway carries the crushed rock from the screening bins to the valley below.

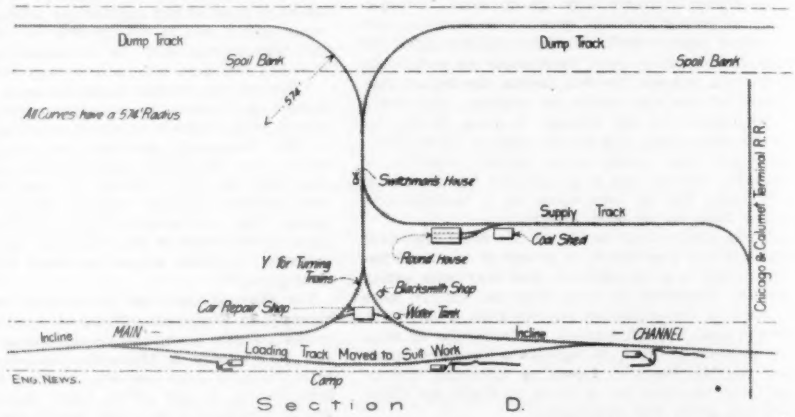



FIG. 27. PLAN OF TRACK SYSTEM SHOWING METHOD OF EXCAVATION ON SECTION D.

## THE CHICAGO MAIN DRAINAGE CHANNEL.
### VII.
### Sections D to A.

Section D.—The contract for this section was awarded to E. D. Smith & Co., Nov. 23, 1892, at 26.437 cts. per cu. yd. for glacial drift. When this contract was awarded it was supposed that the material was entirely glacial drift, but the work of excavation showed that underlying the glacial drift was a very considerable amount of solid rock. The rock was first encountered in November, 1894, and, according to the latest estimates, amounts to 137,691 cu. yds. The glacial drift excavation amounts to 1,877,251 cu. yds. No price has been definitely decided upon for the rock work, but in their estimates the engineers of the Sanitary District have allowed $1 per cu. yd.

The character of the glacial drift on Section D is similar to that on Sections F and E, but somewhat softer. In fact, like the contractors on those sections, the contractors for Section D made claims for a readjustment of price for taking out the hard material, but this claim was not allowed by the Board of Trustees, and work was continued without interruption by the contractors. From the beginning the section has been distinguished by the vigor and good management with which the work has been prosecuted.

Wheel scrapers and New Era graders and wagons were used to take off the top soil, and steam shovels loading into dump cars hauled by locomotives for removing the hard material underneath. Fig. 27 is a plan of the track system used for the steam shovel work, which shows very clearly the method of operation. The steam shovels are of the Bucyrus Steam Shovel & Dredge Co.'s make, and some records of the work done by them are given in the following table:

| Month. | 10-hour shifts. | Cu. yds. per shift. |
|---|---|---|
| September, 1894 [1] | .. | 1,221 |
| October " | .. | 743 |
| November, " | 46 | 338 |
| December, " | .. | 823[1] |
| December, " | 20 | 504[2] |
| January, " | .. | 427 |

[1] Loading into cars. [2] Loading into wagons.

For every month in the above table, except December, the figures given are the average output of two shovels. In December two shovels were worked loading cars as usual, and one shovel loading wagons. In September one shovel of the Bucyrus No. 0 Boom type and one "Special Contractors" shovel were worked, making the excellent average per day worked shown in the table. The average of the same shovels per working day per shovel was 1,123 cu. yds. Unusually good work has been done on this section by the scrapers, teams and New Era graders. In August and September a force of three graders and about 50 teams, working scrapers and wagons took out 42,338 cu. yds., and 37,745 cu. yds., respectively. The contractors state that taking all work together, about 40% of the total cost of labor is chargeable to excavation, as distinguished from conveying the spoil from the pit.

Section C.—At about the middle of this section the main channel enters the bed of the Desplaines River, which cuts across the route in an oblique direction, and follows it through the remainder of

Section C, the whole of Section B and most of Section A. This necessitated the river diversion channel, which had been discontinued at the end of Section E, being resumed and continued through the three sections named. Not only was the excavation of a diversion channel necessitated on Section C, but, owing to the location of the main channel, it had to be excavated before any work could be done on the main channel. In the very beginning, therefore, attention was directed toward opening the river diversion channel at the earliest possible moment.

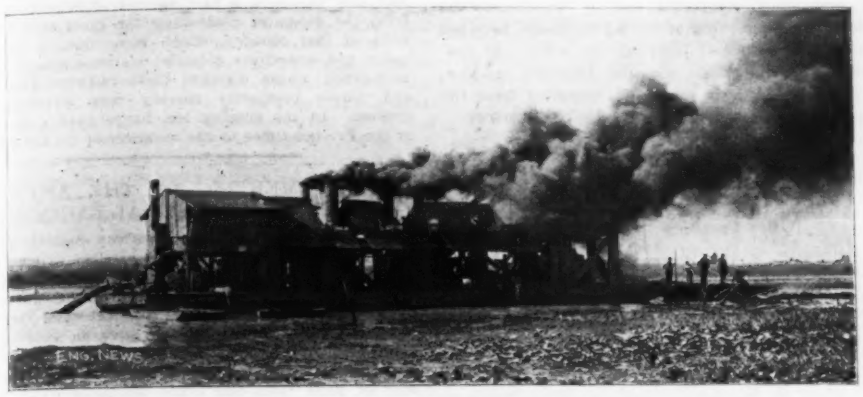



FIG. 29. VIEW OF HYDRAULIC DREDGE EXCAVATING MUCK ON SECTION C.

The contract awarding the work to the Western Dredging & Improvement Co., of Chicago, Ill., was ratified by the Board of Trustees Feb. 1, 1893, and, according to its terms, the river diversion work was to be completed Dec. 1, 1893. Fig. 28 shows the relative location of the old Desplaines River bed, the new diversion channel and the main channel. Steam shovels loading into cars hauled up inclines, and scrapers and wagons, were used in excavating the river diversion channel. After completing the diversion channel a steam shovel was located at A, a track run from A to B, and the old river bed filled at B. Another shovel was located at E, and the material switched back to C and then run out to D, filling in the old river bed as shown.

This filling of the old river bed being completed, the tracks were arranged very much as is shown by the full lines. The track C 1 is swung across the channel into positions 2, 3, 4, etc., as the work progresses, while on the left hand the first cut is taken along the track C F, and the succeeding cuts by means of the switch F G. In addition to the steam shovels and dump cars hauled by locomotives, wagons, scrapers and wheelbarrow gangs were worked, taking out the soft muck of the old river bed, and at the west end of the section a hydraulic dredge was used for some time in the soft muck excavation.

This dredge was somewhat of a departure from the type of hydraulic dredge commonly used in this country. Instead of a revolving cutter for loosening the muck, a series of water jets was used. These jets were directed by hand, by means of long poles to which the nozzles were fastened, and were furnished with water by a pumping engine placed near the front end of the barge. To take away the loosened material, a centrifugal pump, provided with a suction pipe, similar to those used on the ordinary hydraulic dredge, was used. This machine failed to give satisfactory results, although various changes and modifications were made from time to time. The water jets loosened the muck well enough, but in doing so it appeared to scatter it through the water so much that the pump could not suck it up in paying quantities. Various attempts were made to confine the material with canvas and by other methods, but never were made to work successfully.

The dredge was completed about June 1, and in August records of its work were begun. These show the following results:

| Month. | Ten-hour shifts. | Cu. yds. per shift. Per shovel. |
|---|---|---|
| August, 1894 | ... | 280 |
| September, " | ... | 320 |
| October, " | ... | 311 |
| November, " | 21 | 196 |

The accompanying illustration, Fig. 29, is a view of the dredge at work. At the right hand, or forward end, of the barge are shown the men directing the water jets with long poles.

The two steam shovels used are of the Barnhart style, AA pattern, built by the Marion Steam Shovel Co., Marion, O., and their average outputs per ten-hour shift worked for five months were as follows:

| Month. | Ten-hour shifts. | Cu. yds. per shift. Per shovel. |
|---|---|---|
| August, 1894 | ... | 493 |
| September, " | 15* | 820 |
| October, " | ... | 493 |
| November, " | 73 | 503 |
| December, " | ... | 538 |

*Channel flooded by break in cross levee on Section B and work stopped, except for a few days.

The total amount of excavation on Section C, according to the latest revised estimates, is 2,063,653 cu. yds., and the price per yard is 23½ cts. In the muck work, a prism considerably wider than the normal channel section had to be excavated in order to allow the construction of a revetment of hard material along the sides. The regular price was allowed for this extra excavation, but nothing was allowed for placing the revetment. Of course, the extra excavation was limited, the limit being a width beyond that of the normal section equal to five times the depth of the muck above the hard material, providing hard material was not encountered before this width was reached.

Sections B and A.—The route of the main channel, which intersected the channel of the Desplaines River on Section C continues in the bed of that stream entirely through Section B and for the greater part of Section A, and the method of work adopted is to excavate the soft material with hydraulic dredges, and then unwater the sections and use steam shovels and other methods of dry excavation for the hard material. The revised estimates give for section B 1,789,038 cu. yds. of glacial drift at 27 cts. per cu. yd., and for Section A 1,789,038 cu. yds. of glacial drift at 30⅝ cts. per cu. yd., and 4,188 cu. yds. of solid rock at 80 cts. per cu. yd., making the total cost of the two sections, including subsidiary works, $1,398,859. The original contractors were L. D. Connor & Co., who signed the contract in February, 1893, but on Oct. 25, 1893, the senior member of the firm assigned the work to his partners, who continued it under the firm name of Heldmaier & Neu.

FIG. 30 VIEW SHOWING LEVEE OF DISCHARGE BASIN AND HYDRAULIC DREDGE ON SECTION A.

Before any work could be done on the main channel it was necessary to complete the river diversion channel, and accordingly excavation was first begun here. Nothing beyond the ordinary was encountered in this work, but when it came to constructing the levee between the river diversion and main channels, it was found that for practically the whole length of Section A it must be done through a marsh having a depth of from 10 ft. to 20 ft. of soft muck. Hard material for this levee could be secured from the main channel on Sections A and B only by long hauls and for a limited distance, and, in view of the large volume of material required, it was decided to construct a pile trestle along the line of the proposed levee, and fill it in with earth from Section 1, and also from such parts of Sections A and B as it could be obtained. This trestle was built in the fall of 1893, and the work of filling was prosecuted more or less vigorously through nearly the whole of 1894, being completed in the autumn of that year.

Meanwhile, in October, 1893, two hydraulic dredges were put in operation on the main channel. The method of operation has been to take out a prism of the soft muck enough wider than the normal channel section to allow the construction of a hard material revetment on each side. In fact, the stipulations for this character of work on A and B were exactly as already described for Section C.

The two dredges were practically alike, except in minor details, consisting of a substantially-built flat-bottomed barge, carrying the necessary pumping and cutting machinery. From the front end of this barge a ladder, hinged at its upper end to swing up and down in a vertical plane, extends down into the water and supports the suction pipe of a centrifugal pump. This suction pipe has a vertical telescopic joint at its upper end, and a revolving cutter of steel at its lower end. The office of this cutter is merely to attack and loosen the material in its path, so that the pump can act on it. It is operated by an independent engine. From the centrifugal pump the discharge pipe, supported by a line of barges, extends to the discharge basin. At the rear end of the barge is a vertical spud, which, when the dredge is working, is driven down into the soft bottom. On this spud, as a pivot, the barge is swung back and forth by means of ropes attached to the opposite banks of the stream. The cutter thus has a vertical movement and a horizontal swinging movement, and, as it rotates in a single direction only, makes an undercut on its forward swing and an overcut back, gradually cutting a

swath, so to speak, through the soft muck. The swinging ropes, spuds and all other mechanism are operated by power. Detail drawings of one of these dredges were published in Engineering News of Sept. 6, 1894.

The soft muck on which the dredges have worked overlaid the hard glacial drift to a depth varying from a few inches to 25 ft., the top of the hard material being very uneven, sometimes deep pockets of muck being found close to broad shallows. Except in the low water river bed, the uppermost 1½ ft. to 2 ft. of the muck is a solid crust held together by roots and weeds, and floating on the softer material beneath. These roots caused the dredges some trouble, as did also the uneven surface of the hard material beneath, but the chief difficulty arose in keeping the levees inclosing the discharge basin intact. The accompanying illustration, Fig. 30, shows one of these levees, with the discharge basin at the right and the channel with the dredge at work in it on the left. The levees were built of the upper crust of the muck and layers of hay, and were from 10 ft. to 15 ft. high. Time and again they were undermined by the muskrats or sunk into the soft muck and had to be rebuilt.

The channel cut by the dredges varied from 330 ft. to 420 ft. in width, and comprised all the soft material to within 18 ins. to 2 ft. of the hard glacial drift. The greatest depth cut to was 26½ ft., and occasionally the hard material was cut into, the pump throwing out many boulders from 8 lbs. to 15 lbs. in weight, through 2,800 ft. of pipe. The greatest elevation at which material was discharged was 15 ft. above the surface of the water. Ordinarily about 25% of the discharge was solid matter, although this varied from 80% to almost nothing. The specific gravity of the material was about 1.1 immediately after being deposited, and about 1.5 after a couple of weeks' exposure to the air.

The performance of these dredges was very satisfactory, the two excavating 1,538,387 cu. yds. in 882½ shifts, or 1,731.9 cu. yds. for each per ten-hour shift. For single days, of course, the capacity was much greater than this, running up to 7,000 cu. yds. per ten-hour shift. Usually the dredges worked twelve-hour shifts day and night, one hour's shut down for repairs, moving of dredges, etc., as an average, corresponding to one hour's work. All the dredge work was completed in 1894, and the dredges removed from the channel.

The dredging of the soft material on Section B was finished some time in July, 1894. Immediately after a levee was constructed across the channel and pumping began, laying dry the upper half of the section. It may be noted in passing that this levee failed Sept 11, flooding Section C, as already stated. By the last of October, 1894, the section was dry enough to lay railway and steam shovel tracks, and during November and December, 20,838 cu. yds. and 57,820 cu. yds., respectively, were taken out by steam shovels, scrapers and other methods of dry excavation.

During the present year work has been in progress pumping dry the remainder of Sections B and A, and preparing to excavate the hard material. A quite extensive excavating and conveying plant is being erected on Section A, but at present the plans are not sufficiently completed to enable an accurate description. It may be stated, however, that the excavation will be done with especially designed steam shovels built by the Vulcan Iron Works, of Chicago, and that a modification of the bridge conveyor will be used to convey the material to the spoil bank. A description of the system will be given in a future article.

We are indebted to the several contractors and to the engineers of the Sanitary District of Chicago for much aid in securing the information from which this article has been prepared.

## THE TEHUANTEPEC RAILWAY.

In our issue of June 6 mention was made of the ratification by the Mexican Congress of the contract made by theExecutive with Messrs. Samuel Hermanos & Co., of New York and Mexico, for furnishing rolling stock, bridges, lighters, tugs and other equipment for the Tehuantepec Railway, to the value of $3,000,000. Messrs. Hermanos have furnished us with some notes upon this new route between the east and west coasts of North America, and from them we make the following extracts.

The Tehuantepec railway enterprise has met with so many misadventures in the past that many of its present promoters believe that the outside world is quite unconscious of the real value of this now practically completed line of transport. As showing the shortening of sailing distances between some of the principal ports of the world, as contrasted with the route via the Panama railway, the following table is presented, compiled from the Board of Trade returns of the U. S. Treasury:

| | Via Tehuantepec R. R. | Via Panama R. R. |
|---|---|---|
| New York and Hong Kong.. | 11,597 miles | 11,646 miles |
| " " " Auckland .... | 9,345 " | 9,313 " |
| " " " Melbourne.... | 11,068 " | 11,471 " |
| " " " Honolulu..... | 6,566 " | 7,705 " |
| " " " San Francisco. | 4,925 " | 6,107 " |
| Liverpool and " " .. | 8,274 " | 9,071 " |
| New Orleans " " " .. | 3,561 " | 5,415 " |
| " " " Auckland..... | 7,981 " | 9,426 " |
| " " " Honolulu..... | 5,202 " | 7,182 " |
| Liverpool and Yokohama.... | 13,224 " | 14,175 " |
| " " Melbourne.... | 14,113 " | 14,435 " |
| " " Auckland..... | 12,584 " | 12,777 " |
| " " Honolulu..... | 9,805 " | 10,670 " |

In short, if a comparison is made with the Tehuantepec R. R. on sixteen of the main routes of commerce between the East and West, it will be found that the total saving by this route is over 125,000 miles.

It is understood that Messrs. Samuel Hermanos are negotiating for the work of dredging the terminal harbors at Coatzocoalcos and Salina Cruz, and for constructing wharves and jetties on each side of the coast. As it is possible that much of this work will be executed by American capital and enterprise, a short sketch of existing conditions will be interesting.

The terminus at the Gulf coast is at the mouth of the Coatzocoalcos River, which has a watershed area of about 6,500 sq. miles. This river enters the Gulf between two headlands; one formed of sand dunes and the other of solid rock rising about 60 ft. above tide level. At the present time a bar at the mouth of this river prevents the crossing of vessels drawing more than 11½ to 12 ft. of water, but a rise in the river or continued flow of fresh water cuts a deep channel through this bar at certain seasons. As now planned two parallel jetties are to be built out, 4,500 ft. long and 300 ft. apart, extending to water 24 ft. deep. The permanent structures are to be built entirely of rock. It is proposed to build a wharf parallel to the shore, and about 2,000 ft. long, made of creosoted piles, or of steel. As the bank is steep, this wharf need not be more than 100 ft. wide to reach deep water.

On the Pacific coast a breakwater of broken stone will be required, with a coping of concrete blocks. On this side there will be little or no dredging, as there is at all times a considerable depth of water. What is mainly demanded is the construction of a harbor designed to protect shipping during the prevalence of the strong winter "northers." The estimated cost of the jetties and auxiliary work on the Gulf coast is $2,250,000; and the proposed terminal wharf, with its warehouses, tracks and hydraulic plant for handling goods will cost about $360,000. The work at Salina Cruz, on the Pacific side, will amount to about $3,085,000, or a total for both sides of $5,695,000 in gold. The general terms of the contract and conditions of payment are not stated, but Messrs. Hermanos suggest that those interested study the present financial condition of Mexico, after 15 years of absolute political tranquillity, during which time 12,000 miles of railway and 20,000 miles of telegraph have been constructed. They believe that the outlook will be found highly satisfactory, and the work very remunerative on the terms to be offered.

## INTERNATIONAL RAILWAY CONGRESS.

The fifth meeting of the International Railway Congress, held in London, was formally opened at the Imperial Institute on June 26, about 800 delegates being present, representing the railways of 50 countries. The opening address was made by the Prince of Wales, who referred to the enormous railway mileage of the United States and to the development of railways in India and the British colonies. Mr. Dubois, President of the Congress, and Mechanical Director of the Belgian State Railways, replied to the address of welcome. He was followed by Mr. James Bryce, President of the Board of Trade and author of "The American Commonwealth," who stated in the course of his speech that, in regard to the United States, the delegates at the Congress might learn a great deal therefrom in regard to electric traction, and they would be able also to obtain a vast amount of interesting data from the delegates controlling the great railway systems of that country, which were brought into frequent and sometimes delicate relations with the civil authorities whose districts these railways traversed, and whose prosperity thereby was materially increased. In the evening Mr. Bryce gave a reception at the Foreign Office to the members of the Congress.

## DETROIT MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The 31st meeting of the American Society of Mechanical Engineers was opened at Detroit, Mich., June 25, with the President, Mr. E. F. C. Davis, in the chair. Three papers were presented for discussion at this session. Under the title of "The Old and the New," Mr. Robert Allison gave an entertaining description of the machine shop practice of a half century ago, detailing briefly the difficulties in the way of hand tools and crude machines which beset the millwright in his work of building the power machinery of those days. Attention was called to the comparatively good work done by the machinists of these early times, to the very limited means of obtaining information regarding the practice of brother engineers and profiting by it, and to the crude plans made with chalk or pencil on boards, which served as the working drawings for the designer and machinist.

Written discussions were contributed by Messrs. Samuel Webber, Wm. E. Worthen, and Olin Scott, and a brief verbal discussion followed, in which several members took part. In the main these discussions were reminiscent of the experience of the older members in their early engineering practice. The discussion was followed by the reading of the papers on "A New Form of Sterilizer" and "A Portable Disinfecting Plant."

The first-mentioned paper was presented by Mr. A. M. Goodale, of Boston, Mass., and described a sterilizer designed by him for use in a large hospital. Briefly, this apparatus consisted of a ½-in. boiler plate cylinder 36 × 24 ins., in which were placed trays for holding the clothing and dressings used. These trays were surrounded by about 200 ft. of ½-in. steam pipe, and the necessary doors, thermometers, drips, etc., attached to the shell. In operation steam is first admitted to the pipe until the temperature is raised to about 170°, and then live steam admitted into the shell at a pressure of from 25 to 30 lbs. for about 20 minutes. The admission of steam to the shell is then stopped, and the material is dried by means of the steam pipe.

There was no discussion on this paper, and the paper on "A Portable Disinfecting Plant," presented by Mr. W. H. Francis, of Philadelphia, was read. This consisted of an apparatus for subjecting the material to be disinfected to steam heat and a sulphur fumigator, both carried on wagons, so as to be easily transported from place to place. No discussion was presented on this paper, and the consideration of topical questions was taken up.

The first question presented was: "Can it be made practicable to design a machine which shall unite the merits of both the milling machine and the planer? Is not this problem a paradox in machine construction?"

Mr. Henry B. Binsse presented a written discussion which, in substance, argued that the milling machine was not an economical machine as compared with the planer for general shop use. It was only when large numbers of a single article had to be made that the milling machine could be used advantageously. He also considered that for large or medium size work the miling machine was not economical.

Mr. Wm. Kent thought that there was another side to this question, as he knew of cases where the milling machine was used largely for general work. As to the question of the construction of a combination milling machine and planer, he called attention to the ordinary longitudinal and rotary wood planers, the first of which operated like an iron planer and the second like a milling machine, and both of which did the same kind of work.

The next question taken up was as to what system of filtering oil having fine particles of metal in suspension had been found most successful. The Secretary read a statement, sent in by some one who did not give his name, who stated that he used an apparatus consisting of a large and a small pan. The small pan was set inside the larger pan on blocks, and across it were laid two wicks sagging down into it and with their ends hanging over its edges down into the

larger pan. The oil is placed in the smaller pan, is drawn into the wicks by capillary attraction and drips from them into the larger pan. This closed the discussion and the members adjourned to enjoy a collation and a social hour in conversation.

Two sessions were held Wednesday, both of which were devoted entirely to the consideration of the reports of special committees and the reading of professional papers. At the opening of the morning session a communication was read by the Secretary asking that the Society appoint a committee to work with committees appointed by the Fire Underwriters' Association and the Architectural League of New York City, in conducting a series of tests on various kinds of fireproofing. The communication stated that it was proposed to construct a room of steel framework fireproofed with various materials and subject it to a severe fire test by burning a large quantity of fuel in it. On a vote of the meeting it was decided to appoint such a committee.

Mr. Gus. Henning then presented the report of the Committee on Standard Tests and Methods of Testing Materials. This report was merely a statement of the progress of work, referring especially to the tests being conducted by the committee on cast iron. As no results of tests were given, we defer any description of the different qualities of iron tested until such results are available.

In connection with this report, Mr. W. J. Keep, one of the members of the committee, presented two monographs relating to tests on cast iron made under his direction at the Michigan Stove Works, at Detroit, Mich. The first of these monographs described a series of tests made on the transverse strength of cast iron bars varying from ½ in. × 12 ins. to 4 × 24 ins., and the second gave an interesting study of the molecular changes in cast iron due to varying temperatures. An abstract of these papers and the discussion following them will be given in a future issue.

The next report taken up was that of the special Committee on Standard Gages for Sheet Metal, Wire, Etc. The substance of this report, together with an illustration of the form of gage recommended, was given in the report of the proceedings of the Railway Master Mechanics' Association in our last issue, and no further description is necessary, except to say that the gage gives thicknesses in thousandths of an inch. Following these reports was a paper by Mr. F. W. Dean criticising the Society's standard code of reporting boiler tests, which was adopted some ten years ago.

Mr. Dean considered that for comparing different boilers, the statement of evaporation per pound of combustible was of little value, unless the physical and chemical characteristics of the coal were carefully considered. With properly selected fuel a poor boiler might be made to show better results than a good boiler with inferior fuel. To show the true value of a boiler as a generator of the possible heat in the fuel and as an absorber of the heat generated, independent of the quality of the fuel, its efficiency must be determined. The efficiency of a boiler is the ratio between the total heat which any given coal could generate by complete combustion and that part of the heat which is actually absorbed by the water heated and steam generated. The efficiency is determined by knowing the number of heat units that a pound of the coal used will give out when burning under perfect conditions, and the number of heat units that the water evaporated has received. There are two methods of obtaining the heat value of coal: (1) by the calorimeter test, and (2) by chemical analysis. As most engineers desire a chemical analysis of the coal anyway, it will save expense to adopt the method of analysis for determining the heat value. Wherever there is an economizer a boiler trial should in general include a determination of its effect. The statement in the present code basing the commercial horsepower unit on 100° F. and 70 lbs. pressure should be changed to 212° F.

It is of great importance to determine the unit for comparison on an efficiency basis. It would be commercial if the efficiency on coal were taken, but this would require picking out unconsumed coal from the refuse, and would assume that equal percentages of unconsumed coal fell through the grates in different cases. It is therefore best to use the efficiency based on combustible, thus:

$$\text{Efficiency} = \frac{\text{Heat usefully absorbed from 1 lb. of combustible}}{\text{Heat value of 1 lb. of combustible.}}$$

This also is the quantity on which the guarantee should be based, and the contractor should have the following clause in his specifications: "We guarantee that our boiler will give an efficiency of —% referred to combustible consumed on a test of — hours' duration."

In conclusion, Mr. Dean presented a code of rules drawn up on the lines suggested.

Mr. Geo. H. Barrus presented a written discussion, and several of the members present also discussed various features of the paper and the present code of rules. Mr. Barrus stated that it had been understood for a long time that the evaporative performance of a boiler, expressed in terms of water evaporated per pound of coal, or even per pound of combustible, furnished no adequate idea of its efficiency as a steam generator, unless some knowledge was had of the general character of the fuel to which it related. Even with such knowledge the information was unsatisfactory, owing to the wide variation in the value of different coals of nominally the same class. The whole question had been gradually assuming definite shape, until it is now practically settled that unless the calorific value of the fuel used on a boiler test is known by actual trial, and the relation between the heat utilized by the boiler and the total heat of combustion of the coal is ascertained, no reliable information is obtained as to the real performance. The well-worn term "efficiency" characterized the relation noted, but this term had not been applied in common parlance to boiler-work until recently. The matter had grown into some importance in a commercial way, since contracts for boilers were at the present time being executed in which the compensation was based on the percentage of "efficiency" attained, where formerly it was based on the amount of water evaporated with a given kind of coal. He disagreed with Mr. Dean in recommending a chemical analysis for determining the heat value of coal, as it placed that very important part of the work outside the control of the engineer.

In the oral discussion which followed, Prof. D. S. Jacobus, Robt. W. Hunt, Jos. C. Platt and others upheld Mr. Dean in his statement that the present code of boiler tests needed revising, and it was voted that a committee be appointed to draw up a new code of rules for reporting boiler tests, and submit them to the Society.

The next paper read was by Prof. De Volson Wood, and described some experiments made to determine the effect of heat on the tensile strength of iron. Tests were first made on bars of cold iron to determine its strength under normal conditions, and then similar bars of exactly the same size were heated to a red heat and subjected to a stress equal to one-fifth the strength indicated by the first tests, and allowed to cool, some in water and others in air. It was not apparent that the manner of cooling made any difference in the ultimate strength. The six pieces gave the following results:

| | | |
|---|---|---|
| Maximum strength | 51,330 | lbs. per. sq. in. |
| Minimum " | 44,720 | " " " |
| Mean of the six specimens... | 49,165 | " " " |

Four specimens were heated in a similar manner, though some of them were made somewhat hotter, and subjected to a uniform stress of 5,700 lbs., being about one-quarter the strength indicated by the two first specimens, and the stress continued for about 15 minutes. They were afterwards broken cold, with the following results.

| | | |
|---|---|---|
| Maximum | 51,150 | lbs. per sq. in. |
| Minimum | 48,290 | " " " |
| Mean of the four | 50,026 | " " " |

The mean results indicated that there was a slight diminution of strength by stretching iron when hot, but if the stress did not exceed one-quarter of the ultimate strength, the loss of strength was scarcely more than 1½%. The results indicated that unless there be a perceptible elongation while hot, the specimen was not weakened by the treatment. Thus, one specimen elongated 0.23 in. for a length of 5 ins., under a stress of 5,700 lbs., another 0.28 in. for the same length, under a stress of 4,200 lbs., and still another 0.32 in. for the same length and stress as the former ones; and these were the only specimens which broke at less than 50,000 lbs. per sq. in. It is probable that these were better than the others when the stress was applied, as the eye was the only guide for determining the degree of heat.

Mr. Gus. Henning discussed the paper briefly, stating that all that the tests showed was that a large bar was stronger than a smaller bar.

This was followed by a paper entitled, "The Effect of Length of Specimen on the Percentage of Ductility," by Prof. R. C. Carpenter, of Cornell University. This paper described a series of tests on round and flat bars of iron made to determine the feature given in the title. In brief, the general conclusions from the experiments were: (1) that a standard size of specimen is necessary in order that the percentage of ductility shall have any definite value; (2) that the ultimate strength of specimens of boiler steel or of homogeneous wrought iron, for specimens between 2 ins. and 8 ins. in length, is independent of the length of test specimen; (3) that measures of the percentage of elongation taken at the instant of maximum load are more uniform than percentages of ductility taken in the usual manner after rupture had occurred; (4) the percentages of elongation at maximum load are in every case less than percentage of ductility taken after rupture, for specimens 2 ins. to 8 ins. in length, but they are more nearly equal as the specimen is longer.

A short paper by Mr. W. A. Gabriel describing a new form of T-square and its mountings followed, and then Prof. R. C. Carpenter read a paper entitled "Force Required and Work Performed in Driving and Pulling Cut and Wire Nails." Nails were driven into pine by means of a uniform pressure, and the driving force measured at each ¼ in. of penetration. In pulling them, similar measurements were taken. The results of the tests showed:

(1) that very much more force is required to drive a cut nail a given distance than a wire nail; (2) that more force is required to start a cut nail generally than to drive it, and that it invariably starts much harder than a wire nail; (3) the work in inch-pounds per nail required in driving cut nails is much more than that in driving wire nails; (4) the work in inch-pounds in pulling cut nails is about equal, sometimes less and sometimes greater, per nail than that for pulling wire nails; (5) the maximum force per pound in driving or starting wire nails is more nearly equal to that of the cut nails than when estimated on the basis of that of a single nail, but it is still less; (6) the work, in foot-pounds, per pound of wire nails, required for driving is less than that required for the cut nail, and that for pulling is considerably more; (7), the relative efficiency, which is here considered as the ratio of the work of pulling to that of driving, is much lighter for the wire nail than for the cut nail.

In making experiments it was noticed that the cut nail bruised and broke the fibers of the wood, principally at the end of the nail, where as the wire nail simply crowded them apart, and probably did not move them much beyond the point from which they would return by elastic force, and hence the nail would be grasped much stronger per unit of area of surface by the wood. Presenting less surface, there would be, however, less resistance to starting.

To see what the effect of change of form would be, a number of tenpenny cut nails were sharpened on the point by grinding to an angle of about 30°, so that the fibers in advance of the nail would be thrust aside, and not bruised and broken. This served to increase the holding power, over the cut nail of ordinary shape, about 50% in starting force and about 30% in work of resistance to pulling.

There was a brief discussion of this paper by Prof. R. H. Thurston, calling attention to the results of the tests and the advantage of observing them carefully in many classes of work.

The next paper read was by Prof. W. F. M. Goss, of Purdue University, and described various kinds of friction brakes used in the laboratories of that institution. The only discussion was by Prof. D. S. Jacobus, who described a simple form of rope brake so arranged that any degree of friction could be secured by a hand screw and a platform scale.

Mr. Edward J. Willis read a paper describing a planimeter devised so that the horse power could be read from indicator diagrams. This was briefly discussed by Prof. D. S. Jacobus, who stated that the instrument would be found very useful in making rough calculations at intervals during a long engine test when one wished to know about what the engines were doing during the test and before the final records could be worked up.

Prof. R. C. Carpenter then read a paper describing a simple form of coal calorimeter used at the laboratories of Cornell University. In a brief discussion, Mr. Gus. Henning referred to the trouble had by the collection of air above the water in the instrument and suggested that the water be admitted at the bottom of the chamber and the top of the chamber be made dome-shaped instead of perfectly horizontal, so that the air would more readily escape.

Tests made to show the distribution of moisture in steam flowing through horizontal pipes were then described in a paper by Prof. D. S. Jacobus, of Stevens Institute. These tests were made to determine whether, as previous experiments had indicated, the greater part of the moisture ran along the bottom of the pipe in a small stream. It was found that this was indeed the case, at least with the conditions prevailing during the test. The test showed that after steam had passed through 8 ft. of horizontal 3-in. pipe, 95% of the entrained moisture, or over, could be drawn from a ½-in. pipe leading from the bottom of the 3-in. pipe, for quantities of moisture as high as 8% and velocities as high as 25 ft. per second.

The moisture was thoroughly mingled with the steam before entering the 3-in. pipe. The apparatus was so arranged that the great part of the moisture was initially near the top of the pipe, so that it had to fall through the steam during the time taken to travel over the space of 8 ft. The theoretical time required for a body falling freely in space to travel from the top to the bottom of the pipe is about ⅛ second. Hence, the maximum initial horizontal velocity that such a body could have and reach the bottom in a horizontal space of 8 ft. would be 64 ft. per second.

It appears from the experiments, therefore, that for the particular set of conditions which existed, 95% of the moisture can be gleaned from the bottom of a

pipe, if the velocity of the steam is ⅝ that corresponding to the theoretical velocity already menioned. For a velocity of 20 ft. per second, or about ½ the theoretical velocity, 98% of the moisture was drawn from the bottom of the pipe, for quantities of moisture as high as 10%. For a velocity of 43 ft. per second, or 7-10 of the theoretical velocity, about 60% of the total moisture was drawn from the bottom of the pipe, and at ½ of the theoretical velocity about 90% was drawn out.

It cannot be said that these ratios will apply to all cases, and for this reason additional tests are to be made to determine the effect of increasing the length of the horizontal pipe.

A special series of experiments was made, in which a horizontal plate was placed about ¾ in. above the bottom of the 3-in. pipe, and over the ½-in. pipe leading to the calorimefer. The plate was arranged so that all the moisture which collected under it would run into the calorimeter. The object of introducing the plate was to collect all the water which was near the bottom of the pipe, so as to determine to what extent a nozzle, simply tapped into the bottom of the pipe, would remove such moisture. The results of corresponding tests, with and without the plate over the calorimeter nozzle, were about the same, which indicated that a nozzle connected so that its inner end was flush, or slightly below the bottom of the pipe, would remove practically all the moisture which flowed near the bottom of the pipe.

Prof. R. C. Carpenter stated in discussion that experiments conducted by him had shown practically the same results as those described in the paper.

With this discussion the business of the convention for the day was closed. In the evening the members and their friends attended a reception given by the citizens of Detroit at the house of the Detroit Club.

Thursday's Session.

Only one session was held on this day, professional papers being read and discussed during the whole time. The first paper presented was a long mathematical analysis of the Tremont turbine by Prof. De Volsen Wood. There was no discussion, and the paper on "Rustless Coatings for Iron and Steel," by Mr. M. P. Wood, was read. This is the third paper on this same subject presented to the Society by Mr. Wood. The previous papers were abstracted in our issues of July 19, 1894, and Jan. 31, 1895. There was no discussion.

The next paper presented was by Mr. Fred. W. Taylor, entitled "A Piece-Rate System." It is published practically in full on another page of this issue.

The discussion was opened by Mr. W. S. Rogers, who stated that he thought the system was a hard one in some respects. It was impossible at all times for a man to work up to his maximum capacity, as it had been established by some very good record. Moreover, the conditions under which work was done in ordinary shops, little things going wrong, short delays, etc., often prevented the men from reaching the maximum, where the benefit of the high rate came in, and, as a matter of fact, but few men got the rate, and therefore the higher wages. The discussion was continued by Messrs. Wm. Kent, Jos. C. Platt and others, all of whom spoke very favorably of the system recommended.

"The Down-Draft Furnace of Steam Boilers" was the title of the next paper, which was read by Mr. Wm. H. Bryan. The main features of this paper will be brought out in a future article relating to smokeless furnaces. A paper describing a new form of shaft governor, by Mr. E. J. Armstrong, was next read.

This closed the business for the day, and the members adjourned to take an excursion trip up the Detroit River by steamer. A fish dinner was served at Star Island, and the return to the city made in the evening.

Friday's Session.

The first paper read at the concluding session of the convention on Friday was "Expansion Bearings for Bridge Superstructure," by Mr. Geo. S. Morison, which described a modification of his original bearing (Eng. News, Dec. 7, 1893), to adapt it to cases where an unusually low bearing is desired. This modification consists in substituting for the original rocker plate and top plate a single steel casting of much less depth.

The next paper was a description of a large number of tests made on the experimental engine at Cornell University, and was presented by Prof. R. C. Carpenter, of that institution. It consisted largely of the records of tests which had been made at various times without drawing any very definite conclusions as to what the results showed. In the discussion Mr. Wm. Kent spoke of this point and stated that it was too often the case that engineering papers were not completed and rounded out, to show the results in a concise and useful manner. The present paper must be read entirely through to find out what it is all about.

This was followed by a paper presented by Messrs. D. C. Jackson and A. W. Richter, describing the test of a combined electric light and electric railway power plant at Madison, Wis., and which will be briefly abstracted in another issue. The next paper was entitled "A Method of Proportioning Cylinders for Compound Engines," and was presented by Mr. E. C. Knapp. Following this was a useful paper on "Pipe Covering Tests," by Mr. Geo. M. Brill, describing tests made at the works of the Solvay Process Co., Syracuse, N. Y., to determine the most efficient and economical covering for steam pipes. The tests showed that there is no very great difference in insulating qualities between the principal non-conducting coverings on the market.

This closed the business of the convention. On Friday afternoon an excursion was taken to the plant of the municipal electric lighting station, the waterworks pumping station, the Michigan Stove Works and other points of interest, after which the members separated.

WEATHER TABLE FOR MAY, 1895. (Furnished to Engineering News by the Department of Agriculture.)

| | Stations. | Temperature. (Deg. Fahr.) Average. | Max. | Min. | Range. | Wind. Velocity in miles per hour. Average. | Max. | Direction at time of max. velocity. | Precipitation—rain or melted snow—inches. Total. | Heaviest in 24 hours. | No. of rainy days. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Northern Cities. | Northfield, Vt. | 56.8 | 90 | 25 | 65 | 9.0 | 37 | S | 3.38 | 1.67 | 8 |
| | Portland, Me. | 54.6 | 87 | 34 | 53 | 7.6 | 30 | S | 1.89 | 1.08 | 9 |
| | New York, N. Y. | 59.4 | 95 | 38 | 57 | 12.1 | 42 | NW | 2.04 | 1.03 | 8 |
| | Pittsburg, Pa. | 63.3 | 93 | 35 | 58 | 6.1 | 27 | S | 1.97 | 0.56 | 10 |
| | Chicago, Ill. | 59.2 | 94 | 32 | 62 | 17.4 | 50 | N | 1.99 | 0.57 | 10 |
| | Omaha, Neb. | 64.2 | 97 | 38 | 59 | 10.0 | 36 | S | 1.11 | 0.36 | 10 |
| | St. Paul, Minn. | 58.6 | 92 | 31 | 61 | 8.5 | 36 | S | 2.89 | 0.53 | 16 |
| | Duluth, Minn | 50.2 | 81 | 32 | 49 | 9.1 | 38 | NW | 2.13 | 0.43 | 14 |
| | Bismarck, N. Dak | 54.6 | 84 | 30 | 54 | 10.1 | 42 | S | 3.80 | 1.41 | 10 |
| | Average | 57.9 | 90 | 33 | 58 | 10.0 | 38 | | 2.32 | 0.85 | 10 |
| Southern Cities | Washington, D. C. | 62.6 | 95 | 40 | 55 | 6.7 | 30 | N | 3.09 | 0.96 | 17 |
| | Louisville, Ky. | 65.4 | 94 | 36 | 58 | 6.8 | 38 | SW | 2.88 | 0.94 | 12 |
| | St. Louis, Mo | 66.6 | 94 | 40 | 54 | 11.8 | 39 | W | 3.16 | 1.76 | 8 |
| | Savannah, Ga | 71.2 | 93 | 52 | 41 | 7.0 | 25 | NW | 2.20 | 1.15 | 12 |
| | Kansas City, Mo | 65.4 | 99 | 39 | 51 | 10.5 | 40 | N | 3.88 | 0.81 | 11 |
| | Jacksonville, Fla. | 73.8 | 90 | 55 | 35 | 6.7 | 30 | SE | 2.26 | 0.47 | 14 |
| | Chattanooga, Tenn. | 65.4 | 93 | 41 | 52 | 5.6 | 49 | W | 3.52 | 1.23 | 9 |
| | New Orleans, La. | 73.9 | 87 | 58 | 29 | 8.3 | 34 | NE | 7.95 | 4.56 | 12 |
| | Memphis, Tenn. | 69.1 | 94 | 47 | 47 | 7.8 | 35 | NW | 0.46 | 0.16 | 7 |
| | Palestine, Tex. | 69.4 | 88 | 50 | 38 | 6.8 | 32 | S | 11.38 | 3.46 | 15 |
| | Average | 68.3 | 92 | 46 | 46 | 7.8 | 35 | | 4.08 | 1.55 | 12 |
| Western Cities. | Helena, Mont. | 52.0 | 79 | 31 | 48 | 8.2 | 40 | W | 0.87 | 0.35 | 8 |
| | Port Angeles, Wash | 50.4 | 75 | 35 | 40 | 6.5 | 38 | W | 1.55 | 0.67 | 14 |
| | San Francisco, Cal | 57.6 | 89 | 48 | 41 | 13.0 | 36 | W | 0.60 | 0.27 | 6 |
| | Salt Lake City, Utah | 57.9 | 83 | 33 | 50 | 7.4 | 36 | S | 2.29 | 0.94 | 10 |
| | Santa Fe, N. Mex | 54.6 | 81 | 31 | 50 | 8.3 | 38 | SW | 3.46 | 1.38 | 10 |
| | Denver, Colo. | 55.6 | 92 | 33 | 59 | 8.1 | 37 | NW | 2.86 | 1.60 | 11 |
| | Yuma, Ariz. | 79.2 | 109 | 54 | 55 | 8.0 | 39 | NW | 0.00 | 0.00 | 00 |
| | Average | 58.2 | 87 | 38 | 49 | 8.5 | 38 | | 1.66 | 0.74 | 8 |

A new highway law has just been enacted in Connecticut. It provides for the appointment of a permanent State Highway Commission, of which at least one member shall be a capable and experienced civil engineer. Each member is to receive $8 a day and expenses for time actually spent. Provision is made for the construction of improved roads under definite plans and specifications, and contracts must be publicly let by the town authorities under the advice of the commission. The cost of such roads is divided equally between the town, the county and the state. The state's expenditure, however, is not to exceed $75,000 in any one year.

A novel method for securing prompt repairs to defective pavements has been devised by the City Vigilance League of New York city. Printed blanks are furnished to the members, designed for conveniently noting and reporting any defects in pavements. The officers of the league then bring the complaints to the attention of the city officials in charge of paving repairs, who are said to be heartily co-operating with the movement. Any of our readers who may desire to examine copies of the blanks may secure them by addressing Maj. J. W. Howard, Chairman of the League Committee on Street Paving and Repairs, 1 Broadway, New York.

Leakage from city gas mains has been lately investigated in Edinburgh by Mr. D. Irving. In a paper on the subject lately read by him before the Incorporated Gas Institute of that city, he said that in the 10 years, 1883-1893, the leakage had increased 6,000 cu. ft. per mile of main, and the total quantity unaccounted for in the United Kingdom had increased by over 1,834 million cu. ft. in 11 years. In seeking a remedy for this loss, the speaker laid much of the blame upon the use of cheap material purchased on the competitive system and to the tendency to adhere to old methods. The reduction in the amount lost by leakage can only be secured, said Mr. Irving, by strict attention paid to the many little details in each department.

The Bronx River Sewer Commissioners, recently appointed by Governor Morton to consider the feasibility of constructing a trunk sewer and roadway from Katonah, N. Y., in the Croton watershed, to Long Island Sound, have elected Mr. Fordham Morris, of New York city, as president, and Mr. Jas. Wood, of Mount Kisco, secretary. The commission will report to the legislature at its next session, with recommendations.

The contract for the collection and disposal of the garbage of Washington, D. C., for four years and eight months, beginning Nov. 1, 1895, has been awarded to Joshua N. Warfield, of the National Sanitary Co., the present contractor. Some system of cremation will be used.

An International Sanitary Exhibition was opened at Paris on June 1, and will continue until Sept. 15. It is being held in the Palais des Arts Liberaux, Champ de Mars, under the management of M. Maurice Delafon. Among the ten divisions of the exhibition will be the hygiene of dwelling houses, municipal hygiene, industrial and professional sanitation and demography and sanitary statistics. One reason for holding an exhibit of this sort just at this time is said to be the fact that the whole sanitary drainage of the city of Paris is to be remodeled in the next three years, which makes it desirable to give the engineers, architects and others interested an opportunity to see the modern sanitary appliances of other countries.

The price of Birmingham, Ala., pig iron has been advanced by the Tennessee Coal, Iron and Railroad Company to $9.75 per ton for No. 1 foundry iron, and to $8.75 for grey forge iron. This is an advance of $2.75 per ton since April 1. This advance in price also advances the wages of the miners 5 cts. per ton, according to the scale in force, which allows 2½ cts. per ton to the miners for every advance of 50 cts. in price of No. 1 foundry iron above $8.50 per ton. At or below 8.50 the miners receive 37½ cts. per ton.

The engineers and assistant engineers in the various departments at Washington, D. C., must hereafter be selected by competitive examinations conducted on civil service rules, according to a late order of President Cleveland. The engineers in the service requested this action in a petition sent to the President.

Proposals for the sampling and assaying of lead ores imported into the United States will be received at the Treasury Department, Washington, D. C., until July 20. Bids may be submitted for the entire business of sampling and assaying lead ores imported at all of the ports in the United States, or for one port only, or for several ports. The contract will be made for the term of one year, from July 1, 1895, to June 30, 1896. The work will be done under such supervision as the department may consider advisable, and contractors will be held responsible for the results of their sampling and assay. The importation of lead ores during the past fiscal year at the following ports were as follows:

| Customs districts. | lbs. |
|---|---|
| Arizona (Nogales) | 1,211,079 |
| Corpus Christi, Tex. | 1,872,599 |
| Montana and Idaho | 336,395 |
| North and South Dakota | 20,494 |
| Paso del Norte | 41,325,012 |
| Puget Sound, Wash. | 3,347,017 |
| Saluria, Tex. | 1,348,672 |
| San Francisco, Cal. | 1,514,406 |
| Total | 50,975,674 |

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## PERSONALS.

Mr. H. B. Patten has been elected City Engineer of Cheyenne, Wyo.

Prof. R. H. Thurston, of Cornell University, has started on a trip to Europe.

Mr. A. K. Calhoun, has been elected Borough Engineer at Norristown, Pa., vice Mr. A. W. Carson.

Dr. George B. Fowler has been appointed Health Commissioner of New York, to succeed Dr. Cyrus Edson, resigned.

Messrs. Chas. P. Kahler, Janon Fisher and Chas. A. Hook have been appointed Assistant City Commissioners of Baltimore, Md.

Mr. Wilfrid Sandiage, contractor, of Charleston, W. Va., was killed June 26, by a stone falling from a bridge he was building at Stone Cliff.

Mr. Joseph R. Moreland, of Wilmington, Del., has accepted a position as Assistant Engineer on the Grand Trunk Ry., with office at Hamilton, Ont.

Mr. Henri Schneider, the famous manufacturer of guns and armor at Creusot, Belgium, has been made an Honorary Member of the Institution of Civil Engineers.

Mr. William H. Ryan, Superintendent of Water-Works at Salt Lake City, Utah, since 1891, died in that city June 26, at the age of 45. He was born at Olean, N. Y., in 1850.

Mr. E. G. Russell, Superintendent of the Rome, Watertown & Ogdensburg R. R., was reported in our issue of June 27 as having resigned, but we are informed that this was incorrect.

Mr. John V. Dunbar, of the firm of V. A. Dunbar & Son, and a member of the West Virginia Society of Civil Engineers and Surveyors, has been elected City Engineer of Parkersburg, W. Va.

Dr. Cyrus Edson has resigned his position as Health Commissioner of New York city. He has been connected with the Health Department for about 15 years, and was appointed Commissioner about two years ago.

Col. Henry T. Douglas has been appointed City Commissioner of Baltimore, Md. He was formerly Chief Engineer of the Baltimore & Ohio R. R., and has been Chief Engineer of the topographical survey of that city since 1893.

Mr. Chas. W. Powell, railway contractor, died at Chicago, Ill., June 22. He built the eastern division of the Indiana, Bloomington & Western R. R. (now a part of the Cleveland, Cincinnati, Chicago & St. Louis Ry.), and also built other lines in Indiana

Mr. Clinton L. Rossitter, Assistant Superintendent of the Western Division of the New York Central R. R., has been elected President of the Brooklyn Heights R. R., of Brooklyn, N. Y., and will supervise the reconstruction of all the lines of this extensive electric railway system.

Mr. Edward N. Westcott has resigned his position as Registrar of the Water Board of Syracuse, N. Y. He was clerk of the board appointed by Mayor Kirk to report upon a practicable source of water supply, and then became clerk of the Board of Water Commissioners when it was first organized.

Mr. Thomas Henry Huxley, the eminent English scientist and physicist, died at Eastbourne, England, on June 29. Mr. Huxley was born at Ealing, County Middlesex, England, on May 4, 1825, his father being master of a school in that place. With the intention of entering the navy as an assistant surgeon, he studied medicine at the Charing Cross Hospital, and after a long wait he was sent out on the "Rattlesnake" on an exploring and surveying expedition to the Barrier Reef of Australia, New Guinea and the Louisiade Archipelago. During this four years his attention was particularly turned to the study of natural history, and he contributed a number of papers to the Linnean and Royal Societies upon matters of original research. Upon his return the Admiralty did not encourage him in the publication of his works, and after vainly battling against this short-sighted policy, he was, in 1854, made lecturer on natural history at the School of Mines, and in 1855 he was the Fullerian professor of physiology at the Royal Institution and examiner in physiology and comparative anatomy at the University of London. In 1881 he was appointed Inspector of Fisheries, to succeed Frank Buckland; was President of the Royal Society in 1883; of the British Association in 1870, and also of the Royal Geological Society. Mr. Huxley was best known and was most active as an expositor; his individuality as a thinker was remarkable, and in inculcating a new method he insisted upon its intelligent use, as opposed to a slavish following. Thus he accepted the theory of evolution as a plausible explanation of facts, but not as necessarily final. As a speaker he compared unfavorably with his friend Prof. Tyndall, but his literary style was earnest and vigorous, without pretence. He commenced the publication of his various memoirs in 1864, and though his strictly scientific contributions were many and valuable, his wide reputation is chiefly based upon his works intended to popularize scientific information, or to explain in untechnical language abstruse questions of natural history. He was among the first eminent zoologists to lead in this path and he was eminently successful. Though standing in the very front rank of living men of science, of the highest capacity and industry, until 1894, the highest sum paid to Mr. Huxley directly in return for his scientific services, was $5,000 annually. This sum, however, does not include the results of his literary work.

## ENGINEERING SOCIETIES.

### COMING TECHNICAL MEETINGS.

INTERNATIONAL RAILWAY CONGRESS.
June 26 to July 10. At London, England. Secy., F. Welssenbruch, Brussels, Belgium. Secy. of English Branch, W. M. Acworth, London, England.
CIVIL ENGINEERS' CLUB OF CLEVELAND.
July 9. Secy., F. A. Coburn, Case Library Building.
ENGINEERING ASSOCIATION OF THE SOUTH.
July 11. Secy., H. D. Rubm, Nashville, Tenn.
MONTANA SOCIETY OF CIVIL ENGINEERS.
July 13. Secy., Forrest J. Smith, Denver Block, Helena, Mont.
ENGINEERS' CLUB OF MINNEAPOLIS.
July 15. Secy., E. Nexson, Kasota Block.
NEW ENGLAND ROADMASTERS' ASSOCIATION.
Aug. 14, 15. At Boston, Mass. Secy., M. C. Hamilton, Hartford, Conn.
AMER. ASS'N FOR THE ADVANCEMENT OF SCIENCE.
Aug. 28 to Sept. 7. At Springfield, Mass. Secy., F. W. Putnam, Salem, Mass. Local Secy., Wm. A. Webster, Springfield, Mass.
NATIONAL IRRIGATION CONGRESS.
Sept. 16 to 19. At Albuquerque, N. Mex. Secy., Fred L. Allen, Los Angeles, Cal.
NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 11 to 13. At Burlington, Vt. Secy., John C. Witney, Newton, Mass.
AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 8. At Atlanta, Ga. Secy., R. W. Raymond, New York, N. Y.
ROADMASTERS' ASSOCIATION OF AMERICA.
Oct. 8. At St. Louis, Mo. Secy., W. W. Sharpe, Waycross, Ga.
AMERICAN INT. ASSOC. OF RY. SUPTS. OF BRIDGES AND BUILDINGS.
Oct. 15. At New Orleans, La. Secy., S. F. Patterson, Concord & Montreal R. R.; Concord, N. H.
AMERICAN STREET RAILWAY ASSOCIATION.
Oct. 15. At Montreal, Que. Pres., Joel Hurt, Atlanta, Ga.

ASSOCIATION OF ENGINEERS OF VIRGINIA.—The summer meeting was held at Lexington, Va., June 28 and 29. Papers were read as follows: "Water Power and Irrigation." F. H. Newell; "Western River Improvements," Prof. Humphreys; "Deep Sea Sounding," Colonel Brooke; "Experiments on Surface Hardening of Cast Iron." H. A. Gillis.

ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.—This association, of which Mr. H. Hawgood, is President and Mr. F. Van Vleck is Secretary and Treasurer, issued in April, 1895, the first number of its published "Proceedings." The two papers contained in it are devoted to harbor projects, at San Pedro, and for Southern California. The "Proceedings" are published at Los Angeles, Cal.

## NEW PUBLICATIONS.

THE WORK OF THE SANITARY ENGINEER in Time of Epidemics, in Time of War, and in Sudden Calamities in Civic Life. By Wm. Paul Gerhard, Consulting Engineer. New York: Reprinted for the Author from the "Sanitarian" for June, 1895. 8vo; pp. 14.

This paper contains some interesting suggestions in relation to the duties which may devolve upon the sanitary engineer on the occasions named in the title.

AN EXPERIMENTAL STUDY OF FIELD METHODS WHICH WILL INSURE TO STADIA MEASUREMENTS GREATLY INCREASED ACCURACY.—By Leonard S. Smith, Instructor in Engineering, University of Wisconsin, Madison, Wis. Published by the University. Paper, 8vo; pp. 145; illustrated; 35 cts.

This is the full text of a thesis submitted to the faculty of the university for the advanced degree of civil engineer. The thesis was printed, nearly in full, in our issue of June 6.

GROWTH OF DIATOMS IN SURFACE WATERS. By Geo. C. Whipple, S. B., Biologist in Charge, Laboratory of the Boston Water-Works; Biologist to the Water-Works of Lynn. Boston: From the Technology Quarterly, Vol. VII., No. 3, October, 1894. Pp. 18; tables and diagrams.

Unpleasant tastes and odors in drinking waters drawn from surface sources are sometimes caused by diatoms. Mr. Whipple discusses the available information regarding these organisms in the light of investigations made by the Massachusetts State Board of Health on the waters of the state and by the Boston Water Board, under the direction of Mr. Desmond Fitz Gerald, M. Am. Soc. C. E., with the author in charge. Seasonal distribution, especially, is taken up by Mr. Whipple.

CENTRAL AMERICAN RAINFALL. By Mark Walrod Harrington. Washington: Philosophical Society of Washington; Bulletin Vol. XIII.; pp. 30; plates; 1-4.

This is a paper read on March 2, 1895, presenting and discussing rainfall statistics from 31 stations, extending over periods ranging from two months to 19 years. The plates show: (1) The geographical distribution of rain by rates of precipitation at different stations: (2) the kind of rain typical to various portions, whether a norther, cyclonic or trade; (3) distribution of these types throughout the year; (4) the total rainfall for each hour by months at San Jose, Costa Rica. Those interested in Isthmian canal schemes will find the paper of especial interest.

TESTS OF THE STRENGTH OF ARCHES.—Zeitschrift des Oesterreichischen Ingenieur und Architekten Vereines.

In our issue of Dec. 7, 1893, was published a paper by Mr. John C. Trautwine describing the masonry arches on the line of the Stanislau-Woronienka Ry., and reference was made in the article to an extensive series of tests on the strength of arches of various materials, which was carried out by the Austrian Society of Engineers and Architects. These tests were also referred to in a paper by Mr. Fr. Von Emperger, read a year ago before the American Society of Civil Engineers. Some idea of their extent may be gained from the statement that the expense incurred in making them would, at American prices, amount to about $36,000. In a recent letter Mr. Emperger informs us that, at the request of several engineers, he has procured a number of copies of the proceedings of the Austrian Society of Engineers and Architects containing the report of these tests, and will dispose of them at the cost price, $2 each, so long as the supply lasts. His address is No. 71 Broadway, New York city.

CONNECTICUT STATE BOARD OF HEALTH.—Report for the Year 1894, together with the Registration Report for 1893. C. A. Lindsey, M. D., Secretary. New Haven, Conn. 8vo; cloth, pp. xlvii., 325, and 196; illustrations and tables.

There are three brief but interesting papers in this volume by Mr. T. H. McKenzie, M. Am. Soc. C. E., as follows: "Report on the Treatment of Sewage at Pullman," made after a visit to the disposal area in the latter part of 1893, and describing the enlargement of the filtration area then in progress; "Report on the Purification of Water by Sand Filtration at Lawrence, Mass., and the Filtration of Sewage at Brockton;" "Report on Waterbury Sewage Disposal," being a discussion of possible means of disposal.

A unique feature of the report is a careful study by Mr. H. W. Conn, Professor of Biology in Wesleyan University, Middletown, Conn., of the oyster epidemic of typhoid fever among the students at that place in the fall of 1894. A diagram is presented, showing the outlet of a private sewer from a house where two severe cases of typhoid occurred, the outlet being from 250 to 300 ft. from the submerged area where the oysters were fattened which were supposed to have caused the epidemic.

Prof. Herbert E. Smith, M. D., of Yale, Chemist of the Board, submits a "Report of the Investigations of River Pollutions and Water Supplies," made during the year. A number of chemical and microscopical examinations are given.

GENERAL SPECIFICATIONS FOR RAILWAY BRIDGES. By C. C. Schneider, M. Am. Soc. C. E. A. & P. Roberts Co., Philadelphia, Pa. Paper, 6½ × 10 ins.; pp. 20.

These newly published specifications prepared by Mr. Schneider for the Pencoyd Iron Works (A. & P. Roberts Co.), will be examined with much interest by engineers. The specifications require open-hearth steel, with not more than 0.08% of phosphorus. Soft steel is to have an ultimate strength of 50,000 to 60,000 lbs. per sq. in., an elastic limit of one-half the ultimate strength, and a minimum elongation of 26% in 8 ins. Medium steel must have an ultimate strength of 60,000 to 70,000 lbs., with 22% elongation in 8 ins., and the elastic limit requirement is the same as for soft steel. Steel castings (permitted only in machinery for drawbridges) are to be of open-hearth steel containing 0.25

to 0.40% carbon and not over 0.08% phosphorus. All rivets are to be of soft steel. Pins up to 7 ins. diameter are to be rolled, and pins exceeding that diameter must be forged under a steam hammer striking a blow of at least 5 tons, the bloom to have at least three times the sectional area of the finished pins. Full-sized eye-bars must elongate 10% in a gaged length of 10 ft., and must break in the body of the bar. All ironwork, before leaving the shop, must be cleaned of loose rust and scale and be given a coat of boiled linseed oil. Contact surfaces and inaccessible parts are to be painted with iron ore paint mixed with linseed oil.

JULY MAGAZINES.—In Harper's we find an extended and well-illustrated description of the University of Pennsylvania, from the pen of Mr. Francis N. Thorp. Frederic Remington has a characteristic description of bear hunting in the Rocky Mountains, which many an engineer who has roughed it in the Far West will read with interest. "The Century" has a paper on "The Future of War" by Fitzhugh Lee, in which an account is given of the effect of recent inventions upon the destructiveness of military combat. The author says:

Five and a half centuries ago gunpowder was first used upon a battlefield; but the progress in the manufacture and use of it and of the weapons forged to fire it has been slow and gradual until a comparatively late period. The public mind, deeply occupied by other events, has failed to appreciate the marvelous progress made in the efficiency* of firearms since 1865. New smokeless powders, the increased velocity of projectiles, greater accuracy of aim, longer range and greater accuracy of fire have revolutionized tactics and even affected strategy.

The author holds that charges, whether of infantry or cavalry, against troops in intrenched positions, will be practically certain to result only in the annihilation of the attacking force. If the charge of the six hundred at Balaklava were to be repeated to-day, not only would there be none to ride back, but there would be none left to even reach the point where the halt and return were made. Not only this, but to deploy troops in column or in any mass formation within two miles of an enemy equipped with modern machine field guns, will be simply to invite their entire annihilation. The best hope that the author holds out is that the enormous fatality of war may bring about its suppression at no distant day. It certainly would have that effect could statesmen realize the wholly unprecedented slaughter which seems certain to result should the troops of any great civilized nation engage those of an equally well-armed adversary. Another paper in "The Century" deserving a word of notice here is an account of astronomical photography, as practiced at the Lick Observatory.

The "Popular Science Monthly" has a study of the effect of climate upon health, in which the important theory is put forth that the soothing effect of a semi-tropical climate, such as that of the Gulf Coast or of the West Indies might prove a valuable means for the cure of nervous disease. Winter resorts may yet become as much patronized as summer resorts by those who seek relaxation after prolonged mental activity. Mr. Alfred C. Lane has a curious study of the interior of the earth and its probable condition, with the facts of interest regarding it. "The North American Review" contains a short article by Mr. Martin Dodge, of the Ohio Good Roads Commission, explaining his plan of constructing electric railways in country districts, which has already been discussed in this journal. Frederic G. Mather writes on "The Industrial Future of the South," giving a graphic description of its natural resources, which, notwithstanding the boom of a half-dozen years ago, are still in good part undeveloped. "The Disposal of a City's Waste," is the subject of an excellent article by Col. Geo. E. Waring. While he considers the question especially from the point of view of New York city's needs, the paper contains some facts which will interest those who are studying the garbage disposal problem in other cities. Apropos of Colonel Waring, we notice that "Harper's Weekly" of June 22 has two pages of engravings intended to show the improvement in street cleaning which has been made in New York city under the present administration. There are eight pairs of photographs in the set, each pair showing two views of a New York city street, one taken in March, 1893, after a heavy blizzard had piled the streets high with snow, and so obstructed them as to seriously interfere with the work of the street cleaning department; the other, taken in June, 1895. The idea that a comparison of photographs taken at such different seasons and under such different conditions is any fair comparison of the work of the street cleaning department then and now is so absurd that it seems well-nigh incredible that "Harper's Weekly" should have the assurance to publish them. It is a very poor way to uphold a reform administration by such a palpably biased and unfair showing. One expects such things from the ordinary partisan daily; but to see "Harper's Weekly" thus soiling the good name which it has so long held is cause for surprise and disappointment. In "The Review of Reviews," Mr. Albert C. Stevens, editor of "Bradstreet's," writes a graphic account of the part Wall Street bankers have played in maintaining the credit of the Government during the past two years.

* "Proficiency" the author has it, an example of careless editing which we are surprised to find in the "Century."

## TRADE PUBLICATIONS.

GAS GENERATORS.—The W. J. McClurg Gas Construction Co., Pittsburg, Pa. Paper, 3¼ × 6 ins.; pp. 8; illustrated.

This little pamphlet is descriptive of the Miller zigzag reversible gas generator for the generation of gas by the decomposition of steam and oil.

PAGE WOVEN WIRE FENCE.—Page Woven Wire Fence Co., Adrian, Mich. Pamphlet, 9 × 6½ ins.; illustrated.

This is a neat little pamphlet, showing a number of half-tone engravings of the well-known woven wire fencing of this company, as used for railway and stock farm fences in various parts of the country.

WATER-TUBE BOILERS.—Hogan Boiler Co., Middletown, N. Y. Paper, 10¼ × 7 ins.; pp. 8; illustrated.

This pamphlet is descriptive of the Hogan water-tube boiler, in which the arrangement of the tubes forms an inverted T, with a mud drum at each end of the horizontal sections, and a steam drum on top of the vertical section. There are also some "truths to know when buying boilers."

DISINFECTING PLANTS. W. F. Morse, 30 State St., New York. Pp. 8; cuts.

As modern ideas in sanitary science prevail, the need for disinfecting plants as a part of the machinery of municipal health departments and public institutions becomes more evident. This pamphlet describes steam disinfectors suitable for such use, and gives hints in relation to the equipment of disinfecting stations.

MINING, MILLING AND SMELTING MACHINERY.—The E. P. Allis Co., Milwaukee, Wis. 6 × 9 ins.; pp. 120; illustrated.

This illustrated catalogue includes rock crushers, crushing rolls and mortars, stamp mills, amalgamators and concentrators, hoisting and pumping engines, compressors and blowing engines, smelting furnaces, etc. There are also views of complete concentrating plants.

HUMIDITY AND WEATHER FORECASTS.—Julien P. Frietz, Baltimore, Md. Paper, 5¾ × 9¼ ins.

This pamphlet describes the Lambrecht patent polymeter for indicating and measuring the degree of humidity of the atmosphere, without the use of special tables for reducing the observations. Instructions for use and testimonials from users of this instrument are given.

FLUSH TANKS.—The Miller Automatic Siphon for Intermittent Flush Tanks. Used for Flushing Sewers and for Subsoil Irrigation. Pacific Flush Tank Co., 84 La Salle St., Chicago. 12mo; pp. 16; cuts.

The construction and operation of this simple flush tank is described in this catalogue, and directions are given for building the same for street sewers. A table of dimensions, capacities and prices is also included.

POWER TRANSMISSION MACHINERY.—Link Belt Machinery Co., Chicago, Ill. 8vo; pamphlet; pp. 56; illustrated.

This finely illustrated little book describes the great variety of power transmission machinery manufactured by the Link Belt Company. Especial attention is paid to the subject of rope transmission as applied to large shops, and several applications of the system are illustrated.

STEAM SEPARATORS.—Charles D. Mosher, 1 Broadway, New York. Paper; 4 × 6¼; pp. 36; illustrated.

This pamphlet discusses the general purpose of steam separators for removing water, oil, etc., from the steam, and describes particularly the Mosher steam separator, in which the steam passes through a horizontal pipe fitted with a specially-twisted plate. This plate serves to collect the moisture, etc., which is then deposited in a chamber below the pipe.

FEED-WATER HEATER AND PURIFIER.—Adams Boiler Co., Cleveland, O. Paper, 5 × 8; pp. 12.

In the Adams feed-water heater and purifier the exhaust steam enters a perforated dome inclosed in a vertical cylinder, and passes out through a number of ⅝-in. holes in the sides of the dome, while the feed water is discharged on the top of the dome and runs down the perforated sides, absorbing the heat from the exhaust steam and condensing about 15% of the steam.

STEEL CASTINGS.—American Steel Casting Co., Thurlow, Pa. 8¼ × 6¾ ins.; pp. 62; illustrated.

This pamphlet contains illustrations and descriptions of large castings of open-hearth, crucible and nickel steel, including stern shaft bearings weighing 67,135 lbs., hydraulic cylinders, locomotive driving wheel centers, converter trunnions, gear wheels, etc. There are also particulars of a cast steel tender bolster, and the Dunn stockless anchor, the 12,000-lb. head of which is given a drop test of 30 ft.

THE HOUSEHOLD CARBONIZER. The Sanitary Construction Co., 113 Devonshire St., Boston; 30 State St., New York. Pp. 8; cuts.

This pamphlet describes a device designed to facilitate the disposal of garbage by individual householders. To this end a horizontal section is inserted in the vertical run of pipe between the stove or range and the chimney flue. A perforated sheet iron tray is provided for receiving garbage, and this slips into the chamber formed as described above. The waste heat dries the garbage, after which it may be readily burned in the stove or range.

FEED-WATER HEATER AND PURIFIER.—Bruacher Bros., Danville, Ill. 7⅝ × 5⅛ ins.; pp. 16.

This pamphlet is descriptive of the Little Giant Phenomenal feed-water heater and purifier, in which the feed-pipe discharges into the upper one of a series of shallow pans in a chamber filled with live steam, the overflow from pan to pan into a hemispherical basin below, the overflow from this basin flowing direct to the boiler. The impurities in the lower basin can be blown out through a blow-off pipe. The device is made in sizes of 10 to 350 HP., and is claimed to be specially adapted for locomotive boilers.

CONTRACTORS' TOOLS AND MACHINERY.—Thomas Carlin's Sons, Allegheny, Pa. Paper; 6¼ × 9 ins.; pp. 20; illustrated.

Contractors' tools and machinery include an almost endless variety of tools and machines, large and small, from pickaxes to steam shovels, and from simple hoists to steam engines and steam pumps. The present catalogue is very comprehensive and fully illustrated, and gives details of dimensions, weights and prices, while in many cases descriptions are given in considerable detail. Among the specialties noted are concrete mixers of the revolving screw and revolving box types, Carlin's patent dry grinding pan and sectional steel derricks.

A SUMMER NOTE BOOK.—Michigan Central R. R. Co., O. W. Ruggles, Gen. Pass. Agt., Chicago. 8vo; paper; pp. 75; illustrated.

This handsomely printed little brochure, which has been issued by the passenger department of the Michigan Central R. R., is destined to breed much discontent in the breast of the perspiring city dweller, and a wild longing to flee to the green fields and shady woods whose pictures fill its pages. In fact, this is just what it is intended to do; of course, with the understanding that the fleeing is done on the luxurious flyers of the Michigan Central R. R. The book is an excellent example of the high-class work which the passenger departments of our important railways are now turning out.

ELECTRIC ELEVATORS.—Sulzer-Vogt Machine Co., Louisville, Ky. 8vo; pp. 20; illustrated.

This is a supplement to the company's general elevator catalogue, and shows the electrical machinery for the operation of freight and passenger elevators. A slow-speed, multipolar motor is used, and the switch and brake lever are both operated by the hand rope in the car, so that the brake is applied as the current is shut off and released as the current is turned on. An improved hand lever connection for operating the elevators is shown. Several of these elevators are in use, and the cost of operation is said to be from 30 to 60% less than that of hydraulic elevators.

DRAWING INSTRUMENTS.—Theo. Alteneder & Sons, Philadelphia, Pa. 5⅞ × 9 ins.; pp. 111; illustrated; 4 cts.

This is an illustrated descriptive catalogue and price list including almost every variety of drawing instrument, and giving details of patent joints for compasses, spring-blade drawing pens, and other specialties. As to the use of aluminum, it is stated that instruments having joints or wearing surfaces made of this metal, or of any alloy containing a sufficient proportion (or over 15%) to have an appreciable effect upon the weight, are inferior in wearing quality, and are liable to corrosion from the perspiration of the hands. Set squares and ruling-pen handles are, however, made of this metal, and are said to be light, accurate and reliable.

FEED-WATER HEATERS.—Taunton Locomotive Mfg. Co., Taunton, Mass. Paper, 8 × 10 ins.; pp. 63.

This is an illustrated catalogue of the Wainwright steam appliances manufactured by this company. The feed-water heaters shown are of the water-tube and steam-tube types, and a special feature is the use of corrugated copper tubes and corrugated copper expansion joints. Various forms of vertical and horizontal heaters are shown, having from 5 sq. ft. to 3,000 sq. ft. of heating surface, and there are also shown the corrugated copper expansion joint and anchor for this joint. Other specialties are the corrugated-tube

surface condenser, a combination heater supplying boiler feed and hot water for plumbing systems, the Wainwright and Dean steam reheaters for use between the cylinders of compound and triple expansion engines, and the McLaughlin feed-water heater, which uses condensed water from steam pipes and waste hot water.

## CONSTRUCTION NEWS.

### CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

| Bids to be opened. | Work. | Place. | See Eng. News. |
|---|---|---|---|
| July 5. | Stone culverts, | Columbus, O. | June 13 |
| July 5. | Sewers, | Mattoon, Ill. | June 13 |
| July 5. | Brick paving, | Mattoon, Ill. | June 13 |
| July 5. | Water bonds ($18,000), | Princeton, Minn. | June 27 |
| July 5. | Park supplies, | Baltimore, Md. | June 27 |
| July 5. | Brick paving, | Mattoon, Ill. | June 27 |
| July 5. | Street improvement, | Avondale, O. | June 27 |
| July 5. | Brick paving, | Wilkes Barre, Pa. | June 27 |
| July 6. | Water-wks system, | Rockville Center, N. Y. | June 20 |
| | Advertised Eng. News, June 20. | | |
| July 6. | Driving piles, | Sioux City, Ia. | June 20 |
| July 6. | Overflow sewer, | Boston, Mass. | June 20 |
| July 6. | Jail cells, | Auburn, Cal. | July 16 |
| July 6. | Brick arch, | Mansfield, O. | June 20 |
| July 6. | Brick paving, etc., | Lansing, Mich. | June 27 |
| | Advertised, Eng. News, June 27 and July 4. | | |
| July 6. | Grading, | Alexandria, Va. | June 27 |
| July 6. | Brick church, | Morgantown, W. Va. | June 27 |
| July 6. | Pipe sewers, | Indianapolis, Ind. | June 27 |
| July 6. | Iron br.dge superstructure, | Mitchell, Ont. | June 27 |
| July 6. | Grading, etc., | Indianapolis, Ind. | June 27 |
| July 6. | Bridge inchorages, | Covington, Ky. | July 4 |
| July 6. | Brick paving, etc., | Wilkinsburg, Pa. | July 4 |
| July 8. | Courthouse, | Baltimore, Md. | May 9 |
| | Advertised, Eng. News, May 9 to 23. | | |
| July 8. | Buildings, | Lafayette, Ind. | June 13 |
| July 8. | Macadamizing, | Stapleton, N. Y. | June 20 |
| | Advertised, Eng. News, June 20 to July 4. | | |
| July 8. | School building, | Cheney, Wash. | June 20 |
| July 8. | Smoke preventing device, | Cleveland, O. | June 20 |
| July 8. | Plate girders, | Syracuse, N. Y. | June 20 |
| | Advertised, Eng. News, June 20. | | |
| July 8. | Sewers, | East Orange, N. J. | June 20 |
| | Advertised, Eng. News, June 20 to July 4. | | |
| July 8. | Water-works, | Monmouth, Ill. | June 27 |
| | Advertised, Eng. News, June 27. | | |
| July 8. | Highway bridges (3), | Anthony, Kan. | June 27 |
| July 8. | Brick buildings (6), | Medfield, Mass. | June 27 |
| July 8. | Armory repairs, | Albany, N. Y. | June 27 |
| July 8. | Cell house, | Trenton, N. J. | June 27 |
| July 8. | Grading, etc., | Cincinnati, O. | June 27 |
| July 8. | House connections, | Plainfield, N. J. | June 27 |
| | Advertised, Eng. News, June 27. | | |
| July 8. | Pipe sewers, | Bloomfield, N. J. | June 27 |
| | Advertised, Eng. News, June 27 and July 4. | | |
| July 8. | Street lighting, | White Plains, N. Y. | June 27 |
| July 8. | Sewers, | New York, N. Y. | June 27 |
| July 8. | Fire hose, | Baltimore, Md. | June 27 |
| July 8. | Improvement bonds, | Philadelphia, Pa. | June 27 |
| July 8. | Paving, St. Paul, | Minn. | July 4 |
| July 8. | Paving, | Baltimore, Md. | July 4 |
| July 8. | Railway (12 miles), | Montreal | July 4 |
| July 8. | Cement walks, etc., | Rochester, N. Y. | July 4 |
| July 8. | Macadamizing, etc., | Newark, N. J. | July 4 |
| July 8. | Stone arch bridge, | Mamaroneck, N. Y. | July 4 |
| July 9. | Steel water tank, | Cincinnati, O. | June 13 |
| | Advertised, Eng. News, June 20 and 27. | | |
| July 9. | Water-works system, | Red Hook, N. Y. | June 20 |
| | Advertised, Eng. News, June 27. | | |
| July 9. | Brick sewers, | Buffalo, N. Y. | June 27 |
| July 9. | Sewers, | Brooklyn, N. Y. | June 27 |
| July 9. | Pumping engine house, | St. Louis, Mo. | July 4 |
| July 9. | Pier repairs, | New York, N. Y. | July 4 |
| July 9. | Electric light plant, | Olyphant, Pa. | July 4 |
| July 9. | Iron bridge, | Carlisle, Pa. | July 4 |
| July 9. | Pipe sewers, | St. Louis, Mo. | July 4 |
| July 9. | Pipe sewers, | Hackensack, N. J. | July 4 |
| July 9. | Asphalt paving, etc., | Jersey City, N. J. | July 4 |
| July 9. | Brick paving, | Philadelphia, Pa. | July 4 |
| July 10. | Reservoir, | New York, N. Y. | June 20 |
| | Advertised, Eng. News, June 20 to July 4. | | |
| July 10. | Water-works system, | Amboy, Minn. | June 27 |
| July 10. | Wharf repairs at | Port Royal, N. C. | June 27 |
| July 10. | Plans for school buildings (4), | Detroit, | June 27 |
| July 10. | Pipe sewers (1¾ miles), | Pittsfield, Mass. | June 27 |
| | Advertised, Eng. News, June 27. | | |
| July 10. | Sewer materials, | Pittsfield, Mass. | June 27 |
| | Advertised, Eng. News, June 27. | | |
| July 10. | Flagging (29 contracts), | Brooklyn, N. Y. | June 27 |
| July 10. | Paving, etc. (8,250 sq. yds.), | Butler, Pa. | June 27 |
| July 10. | Water-works, | Cornwall-on-Hud'n, N. Y. | July 4 |
| | Advertised, Eng. News, June 13 to July 4. | | |
| July 10. | Water bonds ($26,000), | Aurora, Ill. | July 4 |
| July 10. | Steel bridge, | Ithaca, N. Y. | July 4 |
| July 10. | Granite paving, | New York, N. Y. | July 4 |
| July 10. | Sewers, | New York, N. Y. | July 4 |
| July 10. | Street improvements, | Hoboken, N. J. | July 4 |
| July 11. | Electric light plant, | Knoxville, Tenn. | June 20 |
| | Advertised, Eng. News, June 20 to July 4. | | |
| July 11. | Street lighting, | Knoxville, Tenn. | June 20 |
| | Advertised, Eng. News, June 20 to July 4. | | |
| July 11. | Iron bridge, | New Orleans, La. | June 20 |
| July 11. | Water-works, | Wenona, Ill. | June 27 |
| July 11. | Water tank at | Fort Meyer, Va. | June 27 |
| July 11. | Electric light plant, | Connersville, Ind. | July 4 |
| July 11. | Dredging docks, | Philadelphia, Pa. | July 4 |
| July 11. | Pipe sewers, | Newark, N. J. | July 4 |
| July 11. | Asphalt paving, etc., | Newark, N. J. | July 4 |
| July 11. | Asphalt paving, | Scranton, Pa. | July 4 |
| July 12. | School building repairs, | Chicago, Ill. | June 27 |
| July 12. | Paving, | Buffalo, N. Y. | June 27 |
| July 12. | Macadamizing, | Springfield, Mass. | July 4 |
| July 13. | Sewers, | Rochester, N. H. | July 4 |
| | Advertised, Eng. News, July 4. | | |
| July 13. | Sewer materials, | Rochester, N. H. | July 4 |
| | Advertised, Eng. News, July 4. | | |
| July 13. | Sewers (10,050 ft.), | Ithaca, N. Y. | July 4 |
| | Advertised, Eng. News, July 4. | | |
| July 13. | Court house addition, | East Cambridge. | July 4 |
| July 15. | Brick pvg (13,165 sq.yds.), | Waukegan, Ill. | June 20 |
| | Advertised, Eng. News, June 20 and 27. | | |
| July 15. | Electric lighting, | Vicksburg, Miss. | June 20 |
| July 15. | Sewers, | Swarthmore, Pa. | June 27 |
| July 15. | Court house vaults, | Helena, Mont. | June 27 |
| July 15. | Road (3 miles), | Missoula, Mont. | July 4 |
| July 15. | Brick paving, | Montgomery, Ala. | July 4 |
| July 15. | Water bonds ($200,000), | Waterbury | July 4 |
| July 15. | Pipe sewers (18,000 ft.), | Roselle, N. J. | July 4 |
| | Advertised, Eng. News, July 4 and 11. | | |
| July 15. | Water-works system, | Franklin, Mass. | July 4 |
| July 15. | Water-wks. system, | Hightstown, N. J. | July 4 |
| | Advertised, Eng. News, July 4. | | |
| July 15. | School house, | Baltimore, Md. | July 4 |
| July 15. | Court house plans, | Huntington, W. Va. | July 4 |
| July 15. | Cobblestone paving, | Brooklyn, N. Y. | July 4 |
| July 15. | Paving brick (1,000,000), | Allegheny, Pa. | July 4 |
| July 15. | Brick paving, | Cincinnati, O. | July 4 |
| July 16. | Court house, etc., | Houston, Tex. | June 27 |
| July 16. | Macadamizing, | Morristown (50 m.), N. J. | June 27 |
| | Advertised, Eng. News, June 27 to July 11. | | |
| July 16. | Boiler for water-works, | Dallas, Tex. | July 4 |
| July 16. | Sewers (11,400 ft.), | Wilmington, Del. | July 4 |
| | Advertised, Eng. News, July 4 and 11. | | |
| July 17. | Dredging and removing ledge, | Newport | June 20 |
| July 17. | Improvements, | League Is., Navy Yard. | July 4 |
| July 17. | Steam fire engines (2), | New York | July 4 |
| July 18. | Macadamizing, | Elizabeth, N. J. | July 4 |
| July 19. | Water and light bonds, | Windom, Minn. | June 27 |
| July 19. | Flagging, etc., | Elizabeth, N. J. | July 4 |
| July 19. | Street lighting, | Marcus Hook, Pa. | July 4 |
| July 19. | School building, | Marlette, Mich. | July 4 |
| July 20. | Water-works franchise, | Perth, Ont. | June 20 |
| July 20. | School buildings (2), | Cleveland, O. | June 27 |
| July 20. | Water-works system, | Union, Mo. | June 27 |
| July 22. | Electric light plant, | Washington, D. C. | July 4 |
| July 23. | Water-wks. system, | Cape Vincent, N. Y. | July 4 |
| July 24. | Suspension cableway, | Washington, D. C. | July 4 |
| | Advertised, Eng. News, July 4 and 11. | | |
| July 25. | Electric light plant, | Belefontaine, O. | June 20 |
| July 25. | Brick Paving, | Lorain, O. | July 4 |
| | Advertised, Eng. News, July 4 to 18. | | |
| July 25. | Lighthouse metalwork, | New Orleans, La. | July 4 |
| | Advertised, Eng. News, July 4 and 11. | | |
| July 25. | Water-wks. system, | Warsaw, N. Y. | July 4 |
| July 25. | Lighthouse, | New Orleans, La. | July 4 |
| | Advertised, Eng. News, July 4 and 11. | | |
| July 29. | Water-wks. system, | Momence, Ill. | July 4 |
| | Advertised, Eng. News, July 4 to 25. | | |
| July 29. | Cement (625 bbls.), | Cincinnati, O. | July 4 |
| July 30. | Court house plans, | Atchison, Kan. | July 4 |
| July 31. | Artesian well, | Alvarado, Tex. | July 4 |
| Aug. 1. | Water-wks. system, | Logan, O. | July 4 |
| | Advertised, Eng. News, July 4 and 11. | | |
| Aug. 2. | Electric lighting, | E. Paso, Tex. | May 23 |
| Aug. 5. | Plans for state capitol, | St. Paul, Minn. | Apr. 25 |
| Aug. 6. | Court house, | Dublin, Ga. | June 20 |
| Aug. 12. | Building addition, | Los Angeles, Cal. | June 27 |
| Aug. 20. | Capitol building, | Olympia, Wash. | June 20 |
| Oct. 1 | Plans for art building, | Philadelphia, Pa. | May 23 |
| | Advertised, Eng. News, May 23 to June 27. | | |
| No date. | Water-works, | Crow Agency, Mont. | July 4 |

### RAILWAYS.

#### East of Chicago.

CENTRAL OF NEW BRUNSWICK.—It is reported that this company is to build a 15-mile branch from Chipman, N. B., to the Colonial Iron & Coal Co.'s coalfields at Newcastle. James Barnes, of Buctouche, is the contractor. The furnace to be erected at St. John is to have a capacity of 100 tons of pig iron a day. Gen. Man., E. G. Evans, of Hampton, N. B.

CHATEAUGUAY & NORTHERN.—Bids are asked until July 8 for the construction of that part of the railway from Montreal to Bout de l'Isle, in the parish of Pointe-aux-Trembles, a distance of about 12 miles. The work will include clearing, cutting, grading, bridges, etc.; also tracklaying and ballasting, including the furnishing of all materials. J. P. Mullarkey, Secy., 1608 Notre Dame St., Montreal, Que.

ESCANABA, FRANKFORT & SOUTHEASTERN.—Incorporated in Michigan as a reorganization of the Frankfort & Southeastern, recently sold under foreclosure. Pres., S. W. McCall, of Boston; Vice-Pres., Wm. A. Smith, of Grand Rapids; Treas., Albert C. Hall, of New York; Secy., S. M. Mumby, of Boston. It is reported that the road will probably be operated by the Chicago & West Michigan.

FLINT & PERE MARQUETTE.—Press reports state that this company is quietly figuring with the Wabash to build a broad gage railway from Port Huron, Mich., to Marine City, and thence to Detroit, giving the river towns an outlet, while Port Huron would have a through trunk line and competing freight rates direct to Chicago. Another plan considered by the Flint & Pere Marquette is to broaden the gage to Almont, and build a branch from there to Holly.

HAMMOND & BLUE ISLAND.—The city council of Hammond, Ind., has granted this company a franchise to build a line through the city to the shore of Lake Michigan, and it is stated that the construction will be commenced within 60 days. The G. H. Hammond Co. is interested. Pres., J. P. Lyman; Secy., J. A. Ostrom.

HARDWICK & WOODBURY.—About 100 men and 40 horses are at work on this railway between Hardwick and Woodbury, Vt., a distance of about seven miles. C. A. Watson, Woodbury, Vt., is one of the directors. Gen. Man., E. H. Bossom, St. Johnsbury, Vt.; Pres., Geo. M. Powers, Morrisville, Vt.

OTTAWA VALLEY.—The Ottawa, Ont., "Journal" states that another railway is likely to be built in the Ottawa Valley. It is to extend from Renfrew to Portage du Fort, crossing the Ottawa River at that point and extending into Pontiac county as far as Thorne Centre. The line will be 40 to 50 miles in length. From Renfrew to Portage du Fort, about 15 miles, it will pass through the townships of Horton and Ross, excellent farming districts. At Portage du Fort the Ottawa River will be bridged. The river at this point is narrow. A subsidy of $50,000 has already been passed for the building of a line from Portage du Fort to Thorne. The chief promoter of the new line is A. A. Wright, the king of the Renfrew creamery. It is understood that J. R. Booth, Mr. Gildersleeve, of the K. & P. Ry., and other prominent railway men are interested in the scheme.

PITTSBURG & EASTERN.—About 1,500 men are said to be at work on this railway between Mahaffey and Rankin Summit, Pa., a distance of about 20 miles. The work is reported as averaging 60,000 cu. yds. to the mile, and is to be completed by Oct. 1. The contract for this work was awarded to P. McManus, of Philadelphia, as noted in our issue of June 6.

RACQUETTE LAKE.—The state railroad commission has granted the application of this company for permission to construct a steam road from Racquette Lake to Axton, N. Y., in the Adirondacks. Chas. E. Arnold, of Albany, N. Y., is said to be the chief projector of the road.

WARREN FOUNDRY.—Incorporated in New Jersey June 27 to build a railway from a point on the Easton & Amboy, near Green's Bridge, Warren county, to a connection with the Central R. R. of New Jersey, in the town of Phillipsburg, N. J.; capital stock, $10,000; incorporators, Wm. Runkle, of Orange, N. J.; W. H. Hullck, A. S Deichman, of Easton, Pa.; Warren Foundry & Machine Co., of Phillipsburg, N. J., and others.

#### Southern.

ADDISON & PICKENS.—Contracts for rails and track supplies have been awarded, according to reports, and it is stated that the contracts for the construction will be awarded within a few days. The road will be built from Pickens, W. Va., at the terminus of the West Virginia & Pittsburg, to Addison, Webster county. The work of construction is to begin this month, and will be pushed in the hope of having the road ready for operation by winter. The counties of Webster and Upshur have donated $25,000 toward completing the road, and the remainder necessary to complete the 40 miles of road has been subscribed by the local property owners. The line will follow the Black Fork of Elk River most of the way and will open up a fine timber region. A. H. Kunst, of Weston, W. Va., Gen. Man. West Virginia & Pittsburg, will have charge of the construction of the new line.

CHESAPEAKE & WESTERN.—This projected railway has been noted several times recently. The Old Dominion Construction Co., of which E. C. Machen is president, No. 1 Broadway, New York, has undertaken to build the road, and J. W. Reinhart, late president of the Atchison, Topeka & Santa Fe, is said to have been elected president of the railway company. E. Purcell, Jr., & Co., Harrisonburg, Va., inform us that they have sublet 20 to 24 miles of grading from Harrisonburg east to the foot of the Blue Ridge Mountains to the Ferguson Contracting Co., of St. Louis, and about seven miles of work west from Harrisonburg to Dey River to Van Aken & Hays, of Washington, D. C. The construction has been commenced, and will be pushed as rapidly as possible. Van Aken & Hays have already received 10 carloads of rails, which will be laid as soon as possible. It is stated that 80-lb. rails are used on the main line.

JACKSONVILLE, ST. AUGUSTINE & INDIAN RIVER.—Surveys have been made, and it is reported that grading has been commenced on the extension from West Palm Beach, Fla., south toward Biscayne Bay, 65 miles. Ch. Engr., C. O. Haines, St. Augustine, Fla.

NASHVILLE & MISSISSIPPI DELTA.—Organized to build a railway from Grenada to Nettleton, Miss., 70 miles; Pres., R. H. Elliott, Birmingham, Ala.; Gen. Man., H. L. Underwood, Birmingham, Ala.; Attorney, J. W. Buchanan, Memphis, Tenn.

OHIO RIVER & CHARLESTON.—The fact that surveys were being made for resuming work on this railway between Marion, N. C., and Johnson City, Tenn., was noted in our issue of June 20. The owners of this road are largely interested in the Cincinnati, Portsmouth & Virginia, and Samuel Hunt, president of both companies, is reported to have completed financial arrangements for continuing the construction.

PEACE RIVER PHOSPHATE MINING CO.—This company is building a standard gage railway from Arcadia to Liverpool, Fla., a distance of 15 miles, for the purpose of hauling phosphate rock from its various plants along Peace River to Liverpool and shipping thence by water. The "Railroad Gazette" states that terminals are being constructed at Liverpool arranged for dumping the rocks from the cars on to lighters. The grading is practically completed, and the track is laid from Liverpool seven miles northward. Work was commenced in February last, and the entire line will be completed about Aug. 1. Pres., Joseph Hull, of Savannah, Ga.; Gen. Man., H. M. Comer, Jr., Punta Gorda, Fla.; Ch. Engr., Arthur Pew, Arcadia, Fla.

SANFORD, LILLINGTON & EASTON.—It is stated that the construction of this railway will be commenced within a few days. The road will be about 25 miles in length and has been projected for some time. Address J. D. Boushall, Raleigh, N. C.

ST. MARY'S, LAKE CITY & GULF.—A press report states that this railway has been completed from Toledo, Charlton county, Ga., to Bolougne, Fla., on the Plant system, a distance of 40 miles. The road is owned by Brooks Bros. & Co., of Toledo, who do an extensive lumber, turpentine, and cross-tie business, employing 700 hands. The road will be an important feeder to the Plant system.

SOUTHERN.—This company will probably replace the present wooden trestle at Marshall, Madison county, N. C., by a stone arch, to cost about $25,000 to $30,000.

TENNESSEE CENTRAL.—Tracklaying will be commenced on this road within a few days. About 32 miles have been graded between Monterey and Knoxville, Tenn. G. W. Pearsall, Ch. Engr., Harriman, Tenn.

#### Northwest.

CHICAGO & GREAT WESTERN.—A press report from Hampton, Ia., states that surveyors are at work laying out the route through the city for the extension west of this road. They seem anxious to push the road on west to Clarion and Omaha.

WASHBURN, IRON RIVER & WESTERN.—Incorporated in Wisconsin to build a railway from Washburn, via Iron River to Sandstone, Minn., where connection will be made with the Great Northern. The preliminary survey will be made at once, and the first 30 miles to connect with the Northern Pacific at Iron River will be built this summer. It is stated that arrangements have already been made for the sale of the bonds in the East. The new road will open up some of the most valuable territory in this section of the state; capital stock, $1,000,000; incorporators, W. E. McCord, Chippewa Falls; John Gund, Jr., La Crosse; F. H. Hartshorn, John A. Jacobs, William O'Neil, Lyman T. Walker, Judge Howard Benton, E. S. Owen, Fred T. Yates, A. C. Probert, Frank J. Meehan, M. N. Olsted, John Anderson, Nels Nelson, E. Bergman, D. M. Maxcy, and John Halloran, Washburn; W. H. Bohn, J. A. Pettingill, W. W. Lee, O. H. Campbell, D. S. Clark, A. A. Hobbs, T. F. Mackmiller, King G. Staples, Byron Ripley, Iron River.

#### Southwest.

ARKANSAS.—A press report from Little Rock, Ark., states that Austin Corbin, of New York, is preparing to build a railway from Sunnyside, Chicot county, to

Hamburg, Ashley county, a distance of 40 miles, to secure an outlet for the products of the 300 state convicts he has employed in Chicot county. It will be the only railway in that section of the state and will prove a gold mine to the large cotton plantations through which it will traverse.

BAYOU LAFOURCHE & GULF.—Incorporated in Louisiana to build a railway from a point on the Mississippi River at or near Donaldsonville along Bayou Lafourche to a junction with the main line of the Southern Pacific at Lafourche Crossing; capital stock, $300,000; Pres., R. W. Edwards; Treas., Alcee Bouchereau; principal office, Donaldsonville, La.

### Rocky Mt. and Pacific.

COLORADO & UTAH CENTRAL.—The incorporation of this company was noted last week. It is proposed to build a railway from Denver to Salt Lake City; incorporators, S. S. Chauncey, of New York; Jas. McLean, Paul Cook and C. A. Preston, of Denver; and Wesley Brainerd, of Boulder, Co.o.

DENVER, LAKEWOOD & GOLDEN.—Denver papers state that surveys are being made for extending this railway from Golden to Idaho Springs, 16 miles, this summer. It is stated that the extension will probably be operated by a new company. Pres., S. Newhouse, Denver, Colo.

GREAT SALT LAKE & HOT SPRINGS.—It is reported that this railway, which has just been completed to Farmington, Utah, is to be extended from the south to the north end of Farmington, one mile, and thence to Kaysville, five miles. Most of the right of way has been secured.

PENINSULAR.—Incorporated in Washington to build a steam railway from Big Skookum or Hammersley's inlet, on Puget Sound, in a northwesterly direction to some point on the straits of San Juan de Fuca; capital stock, $300,000; incorporators, George F. Gund and Alfred H. Anderson and others.

VAUGHN & OLYMPIA RY. & NAVIGATION CO.—Organized at Vashon, Wash., to build a railway across Vashon Island (between Tacoma and Seattle); Pres. and Gen. Man., E. G. Edrington; Vice-Pres., H. L. Coblenz; Secy., Geo. M. Robertson; Treas., R. Tavlston; Master Mechanic, Chester Van Slyke.

WYOMING & MISSOURI RIVER.—Incorporated in Colorado June 24 to construct a railway from Aladdin, Cook county, Colo., to the eastern boundary line of Wyoming, and thence through South Dakota to some point on the Missouri River; incorporators, Geo. M. Nix, J. Clement Uhler and John M. Greene.

### STREET AND ELECTRIC RAILWAYS.

COTTAGE CITY, MASS.—An electric railway company is securing right of way for a belt line road seven miles in length on the northeast end of Martha's Vineyard. Josiah Quincy, Jr., of Boston, is interested.

MIDDLETOWN, CONN.—It is reported that the New York, New Haven & Hartford R. R. Co. is considering the question of equipping the Middletown and New Britain branches of its road with electricity.

NEW HAVEN, CONN.—The Manufacturers' St. Ry. Co. has petitioned for a franchise for an electric railway for carrying freight. Geo. S. Barnum, Pres. Bigelow Co.; N. W. Kendall, Pres. Quinnipiac Brewing Co., and S. J. Fox, Pres. National Pipe Bending Co., are interested.

OGDENSBURG, N. Y.—The state railroad commission has granted the Ogdensburg St. Ry. Co. permission to increase its capital stock from $75,000 to $150,000, and to equip its road with electricity. Gen. Man., H. B. Howard.

ROME, N. Y.—The Rome City St. Ry. Co. has been granted permission to equip its road with electricity. Secy., W. P. Rayland.

SYRACUSE, N. Y.—The Syracuse & Suburban R. R. Co. has been incorporated to build an electric railway from South Salina St., in Syracuse, to Manlius, a distance of 12 miles; capital stock, $250,000; directors, John J. King, Osgood V. Tracey and Giles H. Stillwell, of Syracuse; D. W. Gridley, of Thousand Island Park, N. Y., and A. Cady Palmer, of Fayetteville, N. Y.

TROY, N. Y.—It is reported that Jackson & Sharp, of Wilmington, Del., have been awarded the contract for four 28-ft. closed passenger cars, three box cars and four 24-ft. platform cars for the Troy & New England railway, described in our issue of June 13.

McKEESPORT, PA.—It is reported that the Second Ave. Traction Co., of Pittsburg, is considering the question of extending its road up the Youghiogheny River to Buena Vista.

PITTSBURG, PA.—We are informed that on July 22 the application for a charter for the Consolidated Traction Co. will be made at Harrisburg. Legal notice has been filed by Wm. Flinn, C. L. Magee, Geo. Sheppard, Geo. J. Whitney and G. W. Elkins. This will consolidate the Pittsburg, Duquesne and Central and all of their branches.

BALTIMORE, MD.—Local papers state that the contract for building the city extension of the Baltimore, Middle River & Sparrows Point Electric Ry. has been awarded to Benjamin Glenn at private terms. The extension is from 15th St. and Eastern Ave. to Lombard St., to Highland Ave., to Baltimore St., to Loney's Lane. In a few days the contract for the power houses will be awarded. Surveyors are now at work on the line on the North Point road.

SNOW HILL, MD.—It is reported that the Sinepuxent Beach Co. is preparing plans for an electric railway six miles in length along the beach.

MANCHESTER, VA.—John C. Robertson, reported as representing northern parties, has petitioned the supervisors of Chesterfield county for a franchise for an electric railway between this city and Petersburg.

FAIRMONT, W. VA.—The Fairmont Suburban Ry. Co. has been incorporated with a capital stock of $1,300, $130 of which is paid in; incorporators, U. A. Clayton, W. T. Hartman, L. P. Carr and others, of Fairmont.

ATLANTA, GA.—The Atlanta Traction Co. has been reorganized and the name changed to the Atlanta Ry. Co.; capital stock, $300,000. A number of improvements will be made and the electric road extended to the exposition grounds and other parts of the city. Pres., Geo. W. Parrott; Vice-Pres., M. F. Amorous; Secy., Walter Kimball.

LOUISVILLE, KY.—It is reported that the Pennsylvania R. R. Co. is about to equip its branch road to New Albany and Jeffersonville with electricity.

WADSWORTH, O.—The Wadsworth Electric Ry. Co. has been organized; Pres., F. G. McCauley, of Wadsworth; Vice-Pres., W. A. Ault, of Wadsworth; Secy., F. C. Lee, of Wadsworth.

DETROIT, MICH.—A new company has been organized to build an electric railway from this city to Dearborn, a distance of six miles; capital stock, $50,000, with $12,500 paid in. It is reported that work will be begun at once. Directors, John H. Irvine, Strathearn Hendrie, Arthur Bassett and Byron S. Stapleton, Detroit.

CHICAGO, ILL.—The Chicago Electric St. Ry. Co. has been incorporated, with a capital stock of $5,000,000, by Sherman D. Purnia, John Parrott and O. W. Larson.

PONTIAC, ILL.—The Pontiac Transit Co. has been incorporated to build a street railway; capital stock, $100,000; incorporators, C. C. Strawn and I. F. Funk.

MILWAUKEE, WIS.—The Cudahy Advancement Association, 611 Pabst Bldg., has appointed M. J. Mabbett, R. O. Betz, C. M. Kendall and B. A. Eaton a committee to petition the town of Lake for a franchise for an electric railway from Cudahy to the city limits. Patrick Cudahy, as noted last week, is interested.

SHEBOYGAN, WIS.—The Sheboygan Light, Power & Ry. Co. has been incorporated to build a street railway and an electric light plant; capital stock, $200,000; Geo. B. Mattoon and John M. Saemann.

ST. LOUIS, MO.—The St. Louis & Kirkwood R. R. Co. has increased its capital stock from $100,000 to $300,000.——The Southern Electric Ry. Co. is considering the question of extending its road from Carondelet to Jefferson Barracks, a distance of 2¾ miles, at an estimated cost of $52,000. Gen. Man., Jos. S. Minary.

OTTAWA, ONT.—Press reports state that a bill to incorporate the International Ry. Co., which proposes to construct and operate electric railways in Western Ontario, with Hamilton as a central point, has passed the railway committee of the House. The bill empowers the company to issue bonds to the extent of $20,000 per mile of single track and $6,000 per mile additional for double track, and also authorizes it to lease the railway to the Canadian Pacific, Canada Southern or New York Central, and to acquire the franchises and properties of electric lines now in operation. The time for the completion of the undertaking is limited to five years.

### ELECTRIC LIGHT AND POWER.

AVON, N. Y.—Allen, Carpenter & Co. have been granted a franchise for an electric light plant.

MARCUS HOOK, PA.—Bids are asked by the committee until July 19 for lighting the streets from one to five years.

OLYPHANT, PA.—Bids are asked until July 9 for furnishing one 200-HP. engine, two 66 × 18 tubular boilers, one pump and two incandescent dynamos, and for erecting a building for an electric light plant. M. W. Cummings, Jr., Borough Secy.

VINELAND, PA.—Charles Keighley & Son, owners of the water-works, are reported as considering applying for a franchise for an electric light plant.

WASHINGTON, D. C.—Bids are asked until July 22 for putting an electric light plant in the government hospital for the insane, near Washington. Wm. H. Sims, Acting Secy. Dept. Interior.

OWENSBORO, KY.—A proposition to appropriate $25,000 for an electric light plant is being considered by the citizens.

BRAZIL, IND.—Henry Lafollette, Ronald F. McDonald and John Robinson, reported as representing a New York syndicate, are endeavoring to secure a franchise for an electric light plant and for an electric railway.

CONNERSVILLE, IND.—Bids are asked until July 11 for erecting an electric light plant of 30 arc-light capacity. Consult. Engr., John A. Cole, Old Colony Bldg., Chicago; W. L. Cortleyow, Chn. Com.

ST. JOHNS, MICH.—The council has decided to hold an election July 8 to vote on the question of issuing $35,000 in bonds for an electric light plant.

OAKLAND, ILL.—It is reported that the question of putting in an electric light plant is being considered.

ROCK RAPIDS, IA.—It is reported that the city will soon make arrangements to put in an electric light plant.

LEXINGTON, MO.—The citizens have voted to construct an electric light plant, for which bonds will probably be issued.

AUSTIN, TEX.—The citizens have voted to issue $200,000 of 6% bonds for completing the electric light plant and water-works.

WINDSOR, ONT.—The committee has directed the deputy city clerk to advertise for bids for extending the electric light plant, at an estimated cost of $6,000.

NEW COMPANIES.—Meramec Lake Power Co., Chicago, Ill.; $2,000,000; James G. Cozzens, Andrew C. Clark, Edward D. Cooke.

Union Electric Co., Chalerol, Pa.; $1,000; Treas., James S. McKean, Pittsburg.

Alton Ry. & Illuminating Co., Alton, Ill.; $250,000; Joseph F. Porter, Chas. W. Miller, Henry R. Phinney.

Consolidated Electric Purifier Co., Chicago, Ill.; $1,500,000; A. M. Benfield, Wm. C. Archer, John W. Hill.

Virginia Water & Power Co., Virginia, Ill.; $60,000; Geo. Conover, John A. Jones, R. W. Mills, Matthew Vaple.

Wilmette Electric Light & Power Co., Wilmette, Ill.; $15,000; John S. Meyer, John W. Meyer, Edwin B. Webb.

Hall Electric Power Co., Des Moines, Ia.; $500,000; Pres., Robt. H. Laird; Vice-Pres. and Treas., Thurman M. Hall.

Sheborgan Light, Power & Ry. Co., Sheboygan, Wis.; $200,000; Geo. B. Mattoon, John M. Saemann, F. J. Saemann.

American Electric Fuse Co., Chicago, Ill.; $25,000; Eugene Hildebrand, Clarence F. Brown, Ralph W. Bowman.

Electric Boat Co., New York, N. Y.; $8,000; to manufacture electric propellers for boats and other kinds of electrical appliances; F. S. Allen, I. T. McDowell, C. H. Dewitt.

Ellicott City Electric Light & Power Co., reorganized into the Electric Light Co. of Howard County, Ellicott City, Md.; $5,000; John G. Rogers, Louis N. Getz, James N. Gaither, Wm. R. Dorsey, Chas. W. Kraft.

### BRIDGES.

PITTSFIELD, ME.—It is reported that the citizens have voted $3,000 to build a steel bridge in place of the structure known as the short bridge.

HINESBURG, VT.—Eugene N. Sanctuary has been engaged to prepare specifications for a new iron bridge in this town.

BRIDGEPORT, CONN.—The New York, New Haven & Hartford R. R. Co. is reported as preparing plans for a lift bridge in place of the present structure in this city.

ITHACA, N. Y.—Bids are asked until July 10 for constructing a 100 to 120-ft. iron or steel highway bridge across Six Mile Creek, with masonry substructure. The work will include 1,540 cu. yds. of earth excavation, 1,450 cu. yds. of rock excavation, 2,900 cu. yds. of masonry, etc. Engr., K. P. Crandall; A. W. Force, Cy. Clk.

MAMARONECK, N. Y.—Bids are asked by the commissioners of highways until July 8 for constructing a stone arch bridge over Mamaroneck River, between this place and Rye. Address J. A. Kirby, Portchester, N. Y.

ONEONTA, N. Y.—The question of issuing from $15,000 to $30,000 in bonds for a bridge over the railway at Main St. is being considered.

TROY, N. Y.—The city engineer estimates the cost of constructing the Rensselaer St. viaduct at $24,575.

JERSEY CITY, N. J.—The Consolidated Traction Co. has petitioned the Hudson county board of freeholders for permission to build a trestle over the tracks of the Delaware, Lackawanna & Western R. R. at Sandford's Crossing. The trestle will be 20 ft. above the railway, and will cost $25,000. Gen. Supt., H. G. Quigg.

PERTH AMBOY, N. J.—The construction of a bridge between Perth Amboy and South Amboy is being considered.

RED BANK, N. J.—Press reports state as follows: Hubbard's bridge, crossing the Shrewsbury River at Red Bank, will be raised, extended, and an iron sidewalk constructed, at an estimated cost of $9,500, to be equally borne by Shrewsbury and Middletown townships.

CARLISLE, PA.—Bids are asked until July 9 for building an iron bridge over Conodoguinet Creek at Wolf's Ford. George Bethhoover, Clk. Bd. County Comrs.

PITTSBURG, PA.—The Beaver Road & Nevill Island Bridge Co. has been incorporated to build an iron bridge from Nevile Island to Beaver Road in Glenfield; capital stock, $5,000, with $500 paid in. Treas., C. J. McDonald, of Allegheny.

WYOMING, PA.—The Wyoming Bridge Co. has been incorporated to build a bridge over the Susquehanna River at Port Blanchard; capital stock, $1,000; D. O. McCollum, S. S. Herring, V. L. Breese and W. R. Chapin.

COVINGTON, KY.—Bids are asked until July 6 for excavating and masonry for four anchorages for the Covington & Cincinnati suspension bridge. Pres., Bradford Shinkle; Asst. Secy., J. A. Johnson.

CINCINNATI, O.—The county engineer has been directed to prepare plans for a new bridge over the west fork of Mill Creek at Wayne Ave., Springfield township.——The county commissioners have received the following bids for building the wrought iron Pratt truss bridge over Schnapp's Creek: Brackett Bridge Co., bid No. 1, $1,492 (awarded contract); bid No. 2, $1,260; bid No. 3, $950; Indiana Bridge Co., $1,495; King Bridge Co., $1,570; Toledo Bridge Co., $1,515; New Columbus Bridge Co., $1,410; Bradbury & Spencer, $1,746.

TROWBRIDGE, MICH.—It is reported that a steel bridge is to be built across the Kalamazoo River at this place, at an estimated cost of $3,100.

JEFFERSON, WIS.—A town meeting was held July 3 to vote on a proposition to issue $2,000 in bonds for constructing a bridge at Main St.

STEPHENSVILLE, WIS.—The Milwaukee Bridge & Iron Co. has been awarded the contract for building a new 200-ft. span drawbridge over Wolf River at this place, at $5,385.

KANSAS CITY, KAN.—The council has passed an ordinance directing the Kansas City Belt Ry. Co. to build an iron bridge over its road at Park Ave.

### BUILDINGS.

BOSTON, MASS.—J. Reed Whipple, of Young's Hotel and the Parker House, has plans for a 10-story hotel at Boylston and Tremont Sts., estimated to cost about $1,000,000.

EAST CAMBRIDGE, MASS.—Bids are asked until July 13 for erecting an addition to the county court house. J. H. Read, S. O. Upham and Francis Bigelow, Comrs.

PROVIDENCE, R. I.—Subscriptions have been received by Dunscomb & Jennison, 59 Wall St., New York, for the Providence Bldg. Co., organized by E. Rollins Morse & Brother, and E. H. Rollins & Sons, of Boston, for erecting a 10-story steel store and brick bank and office building on the Grosvenor estate, fronting on Weybosset St. and next to the post office. The building, including the purchase of the land, etc., is estimated to cost about $1,500,000. Archs., Winslow & Wetherell, of Boston.

NEW YORK, N. Y.—Stacy C. Richmond has given a mortgage to the Mutual Life Insurance Co. for $1,800,000 on the property extending from 5 to 11 Broadway and reaching through the block to Greenwich St. The property was recently sold by Joseph F. Steir to a syndicate represented by Spencer, Trask & Co. It is proposed to erect a 16-story office building, each floor to have an average of 20,000 sq. ft.——Plans have been filed by Samuel Hirsh, of 43 West 76th St., for a six-story brick office building at 9 and 9½ University Place, and a six-story brick office building at 38 to 42 Clinton Place, the two buildings to cost $270,000; by Alexander Moore, 151 West 61st St., for a seven-story brick apartment house at 68th St. and Central Park West, to cost $125,000.——It is reported that

Jefferson M. Levy has purchased of Mrs. Abby S. Marsnall, of Mt. Brook, N. J., the property at 18 New St. for $225,000, and on this property and that adjoining on Broad and New Sts. it is proposed to erect a 15-story office building at an estimated cost of about $1,000,000, plans for which are now being prepared. ——It is reported that McKim, Mead & White are to prepare plans for reconstructing the New York Custom House building.

PITTSBURG, PA.—The committee of the Pittsburg Armory & Auditorium Association is considering sites for the proposed armory.

PHILADELPHIA, PA.—Arrangements are being made soon to begin the work of constructing the 2d Regiment armory on Broad St., near Diamond. Archs., Rankin & Kellogg.

BALTIMORE, MD.—Bids are asked until July 15 for erecting a school building at Carey St. and Columbia Ave. J. T. Oster, Inspector of Buildings.

HUNTINGTON, W. VA.—Plans are asked by the county court until July 15 for a two-story stone and brick court house, to cost $60,000 to $100,000. F. F. McCullough, Clk.

SOUTHERN PINES, N. C.—It is reported that J. A. Tufts, of Boston, Mass., has purchased 5,000 acres of land near Southern Pines, and will contract for the building of about 500 cottages to be occupied by Northern visitors afflicted with pulmonary troubles. It is probable that he will also erect one or more manufacturing establishments of some kind for the purpose of giving light employment to indigent consumptives. The plans are not yet fully developed. J. T. Patrick, of Southern Pines, is interested.

NEW ORLEANS, LA.—Bids are asked until July 25 for the metal work for the tower and for the reconstruction of the buildings for the Chaudeleur Light Station, La., as stated in our advertising columns. Maj. Jas. B. Quinn, U. S. Lighthouse Engr.

MARLETTE, MICH.—Bids are asked until July 19 for constructing a new brick school building. Arch., J. E. Mills, Chamber of Commerce, Detroit. A. T. Baker, Secy. Bd. Education, Marlette.

BLOOMINGTON, ILL.—It is reported that the Illinois Central Ry. Co. will at once erect a brick and stone passenger station in this city, at an estimated cost of $25,000.

OHICAGO, ILL.—Flanders & Zimmerman have prepared plans for a factory on Van Buren St., near Ashland Ave., for the Illinois Condensing Co., to cost $45,000.——J. H. Moore is preparing plans for a four-story brick and stone factory building for Morgan & Wright at 72 to 86 North May St., to cost $50,000.

ATCHISON, KAN.—Plans are asked by the county commissioners until July 30 for an $80,000 court house, according to reports.

WACO, TEX.—A press report states that the board of directors of the Cotton Palace has accepted new plans for the construction of the palace, the former having been determined to be too expensive. The bids for the construction of the buildings upon the plan adopted have also been received, and the contract awarded to Gordon & Herbert, of this city. The cost of the buildings will be $50,000, and the work of construction will begin at once.

## WATER-WORKS.

GORHAM, ME.—At a special town meeting June 24 the town voted to contract with the Gorham Water Co. for a supply from Sebago Lake or from artesian wells, the village to pay $1,200 a year for ten years for hydrant service and $1,000 a year for 15 years or more. A rate for private consumers was also agreed upon.

KENNEBUNK, ME.—A. W. Meudum, Clk., writes us that at an adjourned town meeting the proposition of the Mousam Water Co., noted last week, was approved subject to certain conditions. The matter is not yet settled. Pres., Henry C. Lord, Alfred, Me.

CENTRE HARBOR, N. H.—J. S. Graves, Dr. L. B. Morrill, D. W. Coe and J. P. Leighton have been appointed a committee to secure plans and estimates for works. A gravity system will probably be adopted; estimated cost, $10,000.

JOHNSON, VT.—The village has voted to issue $9,000 in bonds for works, which will be constructed as soon as possible. C. H. Stearns, Chn. Com.

ACTON, MASS.—W. D. Tuttle, for the committee, writes us that trial wells are being sunk, but as yet without satisfactory results. It is not certain what the town will do. The committee has been instructed to make preliminary examinations and to secure estimates of cost, but it is not probable that any contracts will be awarded this season. Engr., F. L. Fuller, of Boston.

BRADFORD, MASS.—The town is reported about to enlarge and improve the works, recently purchased of the Bradford Water Co. for $80,000.

HYDE PARK, MASS.—The selectmen have been authorized to contract with the Hyde Park Water Co. for 175 hydrants for 10 years at a cost not exceeding $5,500.

LEXINGTON, MASS.—At a town meeting Saturday it was voted, 66 to 54, to purchase the works for $200,000. It is not known whether a majority or a two-thirds vote was necessary to carry.

METHUEN, MASS.—The town has voted to authorize the water commissioners to issue $25,000 in bonds for extending and completing the works.

BRISTOL, R. I.—H. F. Bennett, Town Clk., writes us that no steps have yet been taken for raising money to purchase a water supply, and that it will be several months before such action is taken.

WATERBURY, CONN.—Bids are asked until July 15 for the purchase of $200,000 of 3½% or 4% water bonds. Richard F. Frady, Cy. Clk.

ANTWERP, N. Y.—The contract for works has been awarded to Ferris & Knapp, of Watertown, at $17,292. The only other bid for labor and material complete was that of M. L. C. Cleveland, of Watertown, at $22,970. Engr., Frank A. Hinds, of Watertown.

BINGHAMTON, N. Y.—Plans for the new 45,000,000-gallon storage reservoir, for which the city has been authorized to issue bonds, are being made by S. M. Gray, of Providence, R. I. John Anderson, Secy. Comrs.

BOONVILLE, N. Y.—It is reported that the question of a supply is again being agitated, and that the plans and specifications are being revised for the improvement of the North Lake reservoir, at an estimated cost of about $25,000.

BUFFALO, N. Y.—The corporation counsel having declared the bids for a new pumping engine illegal on the ground that no notice of intention was published, the city clerk will this week publish a notice and the board of public works will subsequently readvertise for bids. The same action will probably be taken on the new water-works tunnel.——The council has voted in favor of purchasing two new 30,000,000-gallon pumping engines for the lower pumping station.

CAPE VINCENT, N. Y.—Bids are asked until July 23 for constructing works, including about 480 tons of 10 to 4-in. pipe, 50 hydrants, pumping engine, etc. Engrs., Hinds & Bond, Watertown; J. A. Scobell, Secy. Comrs.

CLAYTON, N. Y.—R. P. Grant, Chn. Com., writes us that it is proposed to call an election to vote on the construction of water-works and sewers as soon as definite information can be secured to lay before the taxpayers. It is expected that the propositions will carry. The water supply will probably be taken from the St. Lawrence River.

CORNWALL-ON-HUDSON, N. Y.—Bids are asked until July 10 for the construction of works, as advertised in Engineering News. This is a postponement of date from July 5. Engr., Alexander Potter, New York.

PHILMONT, N. Y.—Charles N. Harder, John Hayes and George W. Mosely, are members of the board of water commissioners recently appointed. The citizens have just voted $40,000 for works.

PINE PLAINS, N. Y.—The Pine Plains Water Co. has been incorporated, with a capital stock of $10,000, by J. R. Thompson, of Amenia, and F. Bostwick, William Bostwick, and J. H. Bostwick, of Pine Plains.

WARSAW, N. Y.—Bids are asked until July 25 for constructing works, including about 15 miles of 10 to 4-in. mains. Engrs., Voorhees & Witmer, Buffalo; E. B. Everingham, Secy. Comrs.

BORDENTOWN, N. J.—The water company is reported about to sink artesian wells for a new water supply, the present supply from a creek being unsatisfactory.

HIGHTSTOWN, N. J.—Bids are asked until July 15 for constructing works, as stated in our advertising columns. Engrs., Isaac S. Cassin & Son, Philadelphia; A. S. Voorhees, Chn. Comrs.

PLAINFIELD, N. J.—The water company is reported to have voted to lay 2,400 ft. of new mains on East Front St.

EAST BRADY, PA.—Bids are asked for the purchase of $10,000 in water bonds, according to reports. R. R. McGregor, Clk. of Council.

HAZLETON, PA.—The Diamond Water Co. has awarded the contract for an artesian well at Fisher's Run to John Harper, of Jenkintown, and that for 1,600 ft. of main in North Church St., to H. E. Mandeville.

KNOXVILLE, PA.—The Woods Water Co. was incorporated July 1 to operate at Crafton, Allegheny county; capital stock, $1,000; principal place of business, Knoxville; Treas., Chas. F. Patterson, Allegheny, Pa.

MONACA, PA.—Chandley Bros., of Beaver Falls, Pa., are reported to have been the lowest bidders for constructing the proposed works at about $21,000.

MYERSTOWN, PA.—A. S. Harkness, Quarryville, Pa., Treas. Myerstown Water Co., writes us that the proposed plant will include a 1,000,000-gallon reservoir and about four miles of pipe, principally 8-in., and will cost $18,000 to $20,000, but will not be built until the effect of the dry season is seen on the springs from which it is proposed to secure a water supply; population, 3,000.

MONTROSE, PA.—The special committee appointed to investigate the water supply has recommended that the Consumers' Water Co. be earnestly requested to extend the intake pipe 200 to 400 ft. further into the lake. F. I. Lott, Chn. Com.

PHILADELPHIA, PA.—Hannis, Williams & Bunting, solicitors, of this city, are reported about to apply for a charter for the Villa Nova Water Co.; incorporators, H. B. Chambers, Howard Watkins, Jos. S. Keen, Jr., and Jos. W. Hawley.

WAYNESBORO, VA.—We are informed that the proposed works will include about 2½ miles of 10 to 6-in. mains, 25 hydrants, stand-pipe and power pump. T. H. Antrim and S. H. Lambert are the committee.

ELIZABETHTOWN, KY.—At an election June 22 the citizens voted, 318 to 12, in favor of issuing $13,500 in bonds for works.

ATTICA, O.—The stand-pipe of the new works is reported to have been blown down June 26.

CLEVELAND, O.—Local papers state that plans and estimates are being prepared for a new intake tunnel 9 ft. in diameter and four miles in length, estimated to cost $800,000.

CINCINNATI, O.—Bids are asked by the board of administration until July 29 for 625 bbls. of Portland cement, to be delivered on site of new water tank at Mount Auburn.

HAMILTON, O.—The council has passed an ordinance authorizing an issue of $65,000 in bonds for improving and enlarging the works, as noted last week. John Fisher, Secy. W. W. Trustees.

HURON, O.—Press reports state that the question of works is being agitated.

LOGAN, O.—Bids are asked until Aug. 1 for furnishing materials and constructing a system of water-works in this village, as stated in our advertising columns. Consult. Engr., Frank Snyder, Columbus; B. K. Tritsch, Secy. Trustees.

PERRYVILLE, O.—A. W. Budd, Chn. Trustees, writes us that the following bids were received last week for constructing works:

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| Snyder & Williams, Dayton, O. | $6,215 |
| Toledo Construction Co., Toledo, O. | 6,500 |
| Martin & Air, Newport, Ky. | 6,710 |
| Geo. C. Morgan, Chicago. | 8,191 |

ALEXANDRIA, IND.—The contract for putting in the new works has been awarded to the Seckner Contracting Co., of Chicago, at $47,260.

FOWLER, IND.—Plans for a complete system of works are being prepared by the Seckner Contracting Co., of Chicago.

FORT WAYNE, IND.—The Allen County Medical Society has sent resolutions to the city board of health, condemning the use of surface water from the Spy Run basin. It is stated that additional wells should be sunk at once.

JASPER, IND.—It is reported that an election was held June 29 to vote on the question of works. A. J. Berger, Cy. Clk.

LAKE ODESSA, MICH.—The citizens are reported as agitating the question of works.

MILFORD, MICH.—The question of voting $18,000 in bonds for works was favorably voted upon June 26. It is stated that plans and specifications have been prepared by M. Walker. Geo. P. McCoy, Village Clk.

ATHENS, ILL.—Bids will soon be asked for constructing works, according to reports. G. G. Curnutt, Cy. Clk.

AURORA, ILL.—Bids are asked until July 10 for the purchase of $26,000 of 10-year 5% water bonds. Wm. Pfrangle, Cy. Clk.

CHENOA, ILL.—At a special election June 26 the citizens voted, 215 to 48, in favor of works.

CHICAGO, ILL.—The council has voted to direct the commissioner of public works to make estimates and to advertise for bids for the extension of the north shore inlet, and the construction of an intake tunnel to Garfield Boulevard and West 44th St., or to such points as he may designate; and also, for the construction of a tunnel in the northwestern section of the city, the amount to be paid for such work annually not to exceed $500,000, unless otherwise ordered by the city council.

ELMWOOD, ILL.—Z. L. Gilbert, Cy. Clk., writes us that contracts have been awarded as follows: For pipe, Anniston Pipe & Foundry Co.; boiler, stand-pipe, heaters, etc., Harvey Boiler Works Co.; pump, Deane Steam Pump Co.; hydrants, valves, etc., Detrick Supply Co.

GALESBURG, ILL.—The water committee is reported to have contracted with the Cook Well Co. for the sinking of new wells.

MOMENCE, ILL.—Bids are asked until July 20 for the construction of works, as stated in our advertising columns. Engrs., Seckner Contracting Co., Chicago; Chas. B. Astle, Cy. Clk.

WATERMAN, ILL.—The Waterman Water Supply Co. has been incorporated with a capital stock of $2,000, by Rastus Dean, G. W. Wakefield, F. A. Brown, R. A. Brown and Harry Bradbury.

JUNEAU, WIS.—The contract for constructing works has been awarded to Fairbanks, Morse & Co., of Chicago.

DE PERE, WIS.—The West De Pere Artesian Water Supply Co. is reported to have given a 90 days' option on its plant to Stephen Whitmore, of West Superior. It is reported that Mr. Whitmore desires to purchase the east and west side systems and to put in pumping works, the natural pressure from artesian wells not being sufficient for fire protection.

FRANKLIN, MINN.—Bids are asked until July 15 for constructing works; population, 400. Peter E. Wicken, Village Recdr.

ALTA, IA.—A contract for works has been awarded to Jackson & Moss, of Des Moines, at $6,496, or $5,250 without the pumping plant. Fairbanks, Morse & Co. bid $6,890.

SCHALLER, IA.—At an election June 22 the citizens voted, 95 to 45, in favor of works. A previous election, at which this proposition was carried, was declared illegal.

CROW AGENCY, MONT.—Bids are asked for a water supply system at this place. Lieut. J. W. Watson, Acting U. S. Indian Agent.

KIRKWOOD, MO.—The town board has just rejected two applications for franchises for works, and is now considering an application of Col. Tom Connor, who owns the Joplin, Mo., works.

ST. LOUIS, MO.—Bids are asked until July 9 for building and erecting complete in place the engine house for high-service pumping station No. 3, at Baden. E. S. Foster, Secy. Bd. Pub. Impvts.

ALVARADO, TEX.—Bids are asked until July 31 for drilling an artesian well for the Alvarado Water Supply & Light Co. I. A. Patton, Vice-Pres.

AUSTIN, TEX.—At an election June 24 the citizens voted to increase the bonded debt of the city $200,000 for the purpose of completing the municipal water and light system.

DALLAS, TEX.—Bids are asked until July 16 for one boiler for the city water-works. C. A. Cour, Chn. Com.

GOLIAD, TEX.—J. H. Ewell, Secy. Goliad Water Co., writes us that the contract for works has been awarded to Greathouse, Taylor & Burr, of Beeville, Tex.

NACOGDOCHES, TEX.—The council is reported as making a canvass of the town in regard to a proposition to issue bonds for works.

KINGFISHER, OKLA.—The contract for erecting stand-pipe and laying mains necessary to complete the works has been awarded to the Seckner Contracting Co., Unity Bldg., Chicago.

SEATTLE, WASH.—E. H. Amsdown and F. H. Osgood have informed the city council that they will furnish the city with a gravity water supply from Cedar River Falls. The city engineer has been directed to investigate the project.

FLAGSTAFF, ARIZ.—A press report states that the outlook for new water-works is excellent, and an early decision is expected. The springs on the mountains have been measured and found to carry 90 miner's inches of water.

## IRRIGATION.

GERING, NEB.—A press report states that the petition for the largest irrigation district so far projected under the provisions of the new law has been filed with the board of commissioners of Scotts Bluff county, and will be considered by it at an adjourned meeting on July 6. The canal will be about 70 miles long, beginning in Wyoming, and will cover from 60,000 to 70,000 acres in the western end of the state.

SAN SABA, TEX.—We are informed that the location of the canals of the San Saba irrigation plant will be commenced in a few days. It is proposed to build a solid masonry dam across the San Saba River, below Brady Creek, to raise and store water to irri-

gate between 40,000 and 50,000 acres of land in the valley down to Colorado River. A preliminary survey of this work was made a year ago. Hon. Henry Sayles, of Abilene, Tex., represents the capitalists, and N. Werenskiold, of Dallas, Tex., is the chief engineer.

## SEWERAGE.

FARMINGTON, ME.—At a town meeting held June 24 an appropriation of $300 was voted for surveys for extending the system. The surveys will be made under the direction of the board of selectmen.

NASHUA, N. H.—The following bids were recently received for constructing sewers: Sullivan & Field, $7,650; Cone & Maholit, labor, $3,388; material and labor, $5,330; Wallace & Valcour, labor, $3,324; material and labor, $4,960; A. E. Gay, labor, $2,432; material and labor, $4,119.

ROCHESTER, N. H.—Bids are asked until July 13 for constructing 1,800 ft. of 27 × 20 to 24 × 10-in. brick and 2,150 ft. of 18 to 8-in. pipe sewers, and furnishing 950 lbs. cement, 250,000 brick, etc., as stated in our advertising columns. Engr., Ernest W. Bowditch, Boston, Mass.; Chas. S. Barker, Chn. Com.

BRADFORD, VT.—The question of constructing a system is being considered, and a town meeting for considering the project was held June 20.

ARLINGTON, MASS.—Plans have been prepared for a sewer in Henderson St., estimated to cost $10,500. Plans are being prepared for main sewers in Decatur and Lake Sts.

MILTON, MASS.—At a town meeting held June 29 it was voted to construct a system. E. P. Whitney and J. A. Simpson are the commissioners.

TAUNTON, MASS.—The commissioners will probably soon engage an engineer to examine the plans prepared for the trunk sewer.

CLAYTON, N. Y.—R. C. Grant, Chn. Village Trustees, writes us that it is intended to vote on the question of constructing sewers as soon as something definite can be got together. It is probable the people will vote for the improvement.

FULTON, N. Y.—The commissioners have been petitioned to construct sewers in 11 streets. Geo. E. True, Francis Stiles, Edwin R. Redhead, Comrs.

ITHACA, N. Y.—Bids are asked until July 13 for constructing 10,050 l.n. ft. of 14-in. iron and wood outfall sewer, as stated in our advertising columns. Henry W. Ogden, Ch. Engr.; Roger B. Williams, Chn. Comrs.

GOWANDA, N. Y.—Plans for a system have been submitted by Hedenberg & Kinsey, of New York. The plans call for about six miles of pipe, and the system is estimated to cost about $30,000.

NEW BRIGHTON, N. Y.—It is reported that the New Brighton board of health has decided to appeal to the state board to have the construction of Jewett Ave. sewer begun at once. The sewer is to be built by the villages of New Brighton and Port Richmond, and was authorized by the last legislature.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements, 2622 Third Ave., until July 10 for constructing sewers in three streets.

ONEONTA, N. Y.—The trustees have directed the engineer to make a survey for connecting the outlet sewers and extending them to the river.

HACKENSAOK, N. J.—Bids are asked until July 9 for constructing about 1,600 ft. of pipe sewers in Bogota. R. C. Lydecker, Borough Clk.

NEWARK, N. J.—Headley & Christie have been awarded the contract for constructing a sewer in Lincoln Ave. at $26,000.

NEWARK, N. J.—Bids are asked until July 11 for constructing 1,225 ft. of 15-in. pipe sewers in two streets. J. C. Mundy, Gen. Supt. of Works.

ROSELLE, N. J.—Bids are asked until July 15 for constructing about 18,000 ft. of 12 to 8-in. pipe sewer laterals, as stated in our advertising columns. Engr., Carrol Ph. Bassett, Summit, N. J.; G. A. Rawlins, Borough Clk.

HAZLETON, PA.—The council has voted to advertise for bids for constructing sewers in two streets.

McKEE'S ROCK, PA.—It is reported that the council, at its next meeting, will ask for bids for the construction of a 72-in. sewer from Pine Hollow, run through the town, to the Ohio River, estimated to cost $40,000. A municipal building, with an engine house, is soon to be erected, at a probable cost of $10,000, and Singer Ave. is to be graded from Chartiers St. to the race-track.

PHILADELPHIA, PA.—The director of the department of public works has been authorized to advertise for bids for constructing sewers in 44 streets. Chas. F. Warwick, Mayor.

WILMINGTON, DEL.—Bids are asked until July 16 for constructing 5,500 ft. of brick and 5,000 ft. of pipe sewers, as stated in our advertising columns. T. Chalkley Hatton, Engr. in Charge.

KNOXVILLE, TENN.—The council of North Knoxville has voted to issue $50,000 in bonds for sewers.

CHILLICOTHE, O.—The council is considering the question of constructing a system, at an estimated cost of $75,000 to $100,000.

CLEVELAND, O.—The board of control has prepared plans for sewers in three streets. S. G. McClure, Secy.

TIFFIN, O.—Dr. C. O. Brohst, of the state board of health, has recommended the construction of an intercepting main sewer to carry all the sewage to disposal beds, at an estimated cost of $100,000. A dam is to be constructed at once to raise the water in the Sandusky River several feet, in order to abate a sewage nuisance.

ELWOOD, IND.—It is reported that during this summer Duck Creek is to be converted into an underground sewer, and the specifications will soon be prepared and bids be received for its construction.

RICHMOND, IND.—The board of public improvements is considering the question of constructing a system in the second ward.

FOND DU LAC, WIS.—The council is considering the question of improving the sewerage system. It has been suggested that the Main St. sewer be extended to the lake and a pumping station constructed. Dr. E. E. Atkins, Mayor and Pres. Bd. Health.

KENOSHA, WIS.—N. F. Reichert & Co., of Racine, have been awarded a contract for constructing a sewer at about $6,000, according to reports.

ST. LOUIS, MO.—Bids are asked by the board of public improvements until July 9 for constructing 1,920 ft. of 15 and 12-in. pipe sewers. E. S. Foster, Secy.

MARYSVILLE, CAL.—The citizens voted June 18 to issue $40,000 in bonds for constructing a system. Work will probably be begun at once, as stated in our issue of June 20. F. E. Smith, Cy. Clk.

WOODSTOCK, N. B.—Hedenberg & Kinsey, of New York, have been engaged to submit preliminary plans for a system. W. S. Saunders, Mayor.

## GARBAGE DISPOSAL.

ASBURY PARK, N. J.—The Rider Crematory Co. is reported to have offered to construct a garbage crematory at this place for $10,000, and it is stated that the offer will probably be accepted by the borough council.

ORANGE, N. J.—It is reported that this city and the township of East Orange will either have to contract with a Newark firm to dispose of the garbage of the two places, or erect a garbage crematory, and that it is probable that the latter will be done.

WASHINGTON, D. C.—The contract for collecting and disposing of garbage for the four years and eight months beginning Nov. 1 has been awarded by the district commissioners to Joshua N. Warfield, at $57,000 a year, and it is stated that arrangements are being made for the construction of three Dixon crematories. Six bids were received for this work.

CHICAGO, ILL.—The Thackeray Incinerating Co., of this city, has been incorporated by C. S. Hardy, M. T. Kendig and Julius Moses; capital stock, $500,000. The company is reported as about to try to obtain a contract for the disposal of the city's garbage as it is disposed of in Montreal. The Charles Thackeray garbage incinerators used in Montreal were described in our issue of Nov. 29, 1894.

## STREETS AND ROADS.

SPRINGFIELD, MASS.—Bids are asked until July 12 for grading and macadamizing Federal St. Co.. A. Mordecai, Ordnance Dept., U. S. Army.

HARTFORD, CONN.—Press reports state that the house has passed the good roads bill with an appropriation of $75,000. A board of three commissioners is to appointed by the governor to indicate the roads throughout the state—main highways—which are to be macadamized; the town, county and state are each to pay one-third the expense.

NEW HAVEN, CONN.—The council has been petitioned to pave portions of two streets with asphalt.

BROOKLYN, N. Y.—Bids are asked until July 15 for paving Eldert St. with cobblestones. A. T. White, Comr.

BUFFALO, N. Y.—The board of public works has received the following bids for paving Doat St.: German Rock Asphalt Paving Co., $58,371; Barber Asphalt Paving Co., $58,775. Roesch Ave.: Buffalo Paving Co., brick, $22,983; American Bituminous Rock Co., $27,543; L. H. Gipp, Tonawanda, $19,650.

NEW YORK, N. Y.—Bids are asked by the commissioner of street improvements, 2622 Third Ave., until July 10 for grading a street and paving two streets with granite blocks.

ROCHESTER, N. Y.—Bids are asked until July 8 for constructing cement sidewalks in four streets and for paving Ambrose St. with brick. T. J. Neville, Clk.

ELIZABETH, N. J.—Bids are asked until July 19 for 850 lin. ft. of curbing, 360 sq. yds. of flagging and 3,400 cu. yds. of excavation. N. K. Thompson, St. Comr.

ELIZABETH, N. J.—Bids are asked until July 18 for 14,600 sq. yds. of telford macadam paving, 4,210 sq. yds. of trap block paving, 9,300 lin. ft. of curbing, etc. N. K. Thompson, St. Comr.

HOBOKEN, N. J.—Bids are asked until July 10 for improving Eighth St. and laying 3,000 l.n. ft. of cross walks. M. V. McDermott, Cy. Clk.

JERSEY CITY, N. J.—Bids are asked until July 9 for 10,830 sq. yds. of asphalt paving, 1,900 sq. yds. of Belgian block paving, etc.; four contracts. John C. Kaiser, Chn. Com.; Geo. T. Bouton, Clk. Comrs.

MORRISTOWN, N. J.—Bids are asked until July 16 for grading and macadamizing about 30 roads, over 50 miles, as stated in our advertising columns. Engr., Wm. E. King, Landing, N. J.; J. C. White, Clk., Morristown.

NEWARK, N. J.—Bids are asked by the committee of the board of freeholders of Essex county until July 8 for grading and paving 1,500 lin. ft. of Springfield Ave. with telford macadam, for furnishing stone and flagging for repairing Washington Ave., and for constructing 2,000 ft. of 24-in. drain in Valkburg. James Owen, County Engr.—Bids are asked until July 11 for 5,450 sq. yds. of asphalt paving, 3,667 sq. yds. of flagging, etc. J. C. Mundy, Gen. Supt. of Works.

ALLEGHENY, PA.—A. V. Purnell has been awarded the contract for repaving Federal St. with Ligonier blocks, at $11,839.

ALLEGHENY, PA.—Bids are asked until July 15 for furnishing 1,000,000 paving brick. Robert McAfee, Dir. Dept. Pub. Wks.

PHILADELPHIA, PA.—Bids are asked until July 9 for paving an alley with brick. T. B. Stulb, Health Officer.

SCRANTON, PA.—Bids are asked until July 11 for paving Clay Ave. with asphalt on concrete. M. T. Lavelle, Cy. Clk.

WILKINSBURG, PA.—Bids are asked until July 6 for 76,900 sq. yds. of brick paving, 47,000 lin. ft. of curbing, etc. Address Edeburn & Cooper, Borough Engrs., 410 Grant St. Pittsburg.

BALTIMORE, MD.—Bids are asked until July 8 for grading and paving six streets. H. T. Douglas, Cy. Comr.

MONTGOMERY, ALA.—Bids are asked until July 15 for paving South Court St. with brick, and constructing sidewalks in the same street. J. W. Persons, Cy. Engr.; R. H. Somerville, Treas.

KNOXVILLE, TENN.—The council of North Knoxville has passed an ordinance authorizing an issue of $25,000 in bonds for street improvements.

CINCINNATI, O.—Bids are asked by the board of administration until July 15 for paving two streets with brick.

CINCINNATI, O.—The county engineer estimates the cost of the proposed Cincinnati, Oakley and Madison Ave. improvement at $142,344. The work will include 55,130 sq. yds. of brick, to cost $82,695; 9,188 cu. yds. of concrete, to cost $27,564, etc.—The county commissioners have awarded the contract for the improvement of the Hanley road to Reubel Bros., at $16,219. The other bidders were: John Wiseman & Co., $16,865; Ruffner Bros., $18,508; William Fogarty, $23,406.

COLUMBUS, O.—Bids are asked until July 11 for improving 9,900 l.n. ft. of Goshen Lane. W. H. Halliday, Audr. Franklin county.

LORAIN, O.—Bids are asked until July 25 for paving with brick on 6 ins. of concrete foundation, and also with brick on 10 ins. of broken stone foundation, as stated in our advertising columns. We are informed that about 51,000 sq. yds. of brick paving will be will be laid, and about 16,000 lin. ft. of curbing this season. Engr., L. A. Fauver; George E. Hall, Clk.

HARRISVILLE, MICH.—The board of supervisors of Alcona county has voted to hold an election Aug. 20 for the taxpayers to vote on the proposition to adopt the county road system.

LAPEER, MICH.—It is reported that the question of brick or macadam paving is being considered.

SAGINAW, MICH.—The board of public works has approved the plans of the city engineer for paving one portion of Genesee St. with asphalt, at an estimated cost of $23,525, and another part of Genesee St. and Jones St. with brick, at an estimated cost of $26,250.

HOOPESTON, ILL.—It is reported that the city will do $35,000 worth of paving this year.

ST. PAUL, MINN.—Bids are asked until July 8 for paving Sibley St. with granite blocks, and portions of St. Peter St., with asphalt and cedar blocks. John C. Mueller, Clk. Bd. Pub. Wks.

MISSOULA, MONT.—Bids are asked until July 15 for constructing about three miles of wagon road, according to reports. D. J. Bailey, County Clk.

PORTLAND, ORE.—A. E. Hammond, County Surv., has completed surveys for a road from Lents to connect with the Powell Valley county road, a distance of a mile.

## MANUFACTURING PLANTS.

SALEM, MASS.—John Looney has applied for permission to erect a morocco factory, 144 × 32 ft., with an L 30 × 40 ft. on Proctor St.

DURYEA, PA.—It is said that a syndicate has been formed for the purpose of building a large silk mill at this place, and that Sol. Hirsch, of Scranton, has taken $10,000 worth of stock in the new project.

SHAMOKIN, PA.—It is stated that a number of Philadelphia and Scranton capitalists have formed the Girard Coal Mining Co., have purchased the Black Diamond Colliery for $50,000. The company will construct a new breaker and sink another slope. The entire plant will give employment to 1,000 hands.

BALTIMORE, MD.—The Baltimore Sugar Refining Co. is reported to have decided to issue $650,000 of preferred stock for the purpose of rebuilding the refinery at Curtis Bay, destroyed by fire a year or two ago. The new plant will be much larger than the other, and will have a capacity of 1,500 barrels per day. Pres., W. W. Spence, Baltimore.

GASTONIA, N. C.—The cotton mills at this place expect to put in considerable additional machinery during the ensuing fall months. Address E. L. Wilson, Pres. Gastonia Cotton Mills Co.

MAGNOLIA, N. C.—J. Baker & Son, of this city, whose steam saw mill and grist mill was destroyed by fire recently, will put in a new plant.

ROCKY MOUNT, N. C.—W. E. Worth & Co. are said to be about to establish a 20-ton artificial ice manufactory at this place.

GREERS DEPOT, S. C.—A company is being formed to build and equip a new cotton mill plant at this place. Address J. A. Robinson.

ROCK HILL, S. C.—A 6,000-spindle, 300-loom cotton mill is to be erected at this place. Address Secy. Manchester Cotton Mills Co., Rock Hill.

LAVONIA, GA.—A cotton mill is to be erected and equipped at this place, and $25,000 of the stock has already been subscribed.

HENDERSON, KY.—We are informed that a new cotton mill is to be equipped at this place as soon as the buildings, which have been contracted for, are completed.

CHATTANOOGA, TENN.—A deal is reported to have been closed by the Southern Land & Loan Co. by which the Casey & Hedges Co. have acquired a tract of land on Sydney St., where it will erect a boiler factory to cost $20,000. The company at present employs about 75 men.

TOELDO, O.—The Toledo Metal Wheel Works is reported about to enlarge its factory and employ more men.

## MISCELLANEOUS CONTRACTS AND SUPPLIES.

MARINE RAILWAY.—Savannah, Ga.—The Jones Marine Ry. Co. has been incorporated by J. W. Jackson, Frances Jones and Florence H. Jackson.

PIER WORK.—New York, N. Y.—Bids are asked by the department of docks until July 9 for repairing the pier at the foot of West 51st St., North River.

FIRE ENGINES.—New York, N. Y.—Bids are asked by the fire commissioners until July 17 for two third-size Amoskeag and two third-size La France new-style steam fire engines.

DREDGING.—Philadelphia, Pa.—Bids are asked until July 11 for dredging docks and in front of bulkheads, not belonging to the city, where city sewers empty. Joel Cook, Pres. Port Wardens.

NAVY YARD IMPROVEMENTS.—Washington, D. C.—Bids are asked until July 17 for constructing a sea wall, dredging, and other improvements at the League Island navy yard. E. O. Matthews, Ch. of Bureau of Yards and Docks.

SUSPENSION CABLEWAY.—Washington, D. C.—Bids are asked until July 24 for furnishing, setting up complete and testing a suspension cableway, as stated

in our advertising columns. Maj. John G. D. Knight, U. S. Engr. Office.

**TELEPHONE LINE.**—Rutherfordton, N.C.—It is proposed to build a telephone line from Rutherfordton to Asheville, N. C., via. Ayr, Chimney Rock, and Hickory Nut Gap, and a company is being organized for this purpose. Col. John O. Tipton, Rutherfordton, N. C., can give information.

**CARS.**—San Francisco, Cal.—The San Francisco & San Joaquin Valley R. R. Co. is reported to have received 13 bids for building box and flat cars, the lowest being that of Carter Bros., of New Newark, Alameda county, Cal., at a little over $78,000, and the next bid being that of the Stockton, Car, Machine & Agricultural Works at $88,589.

**TELEPHONE FRANCHISES.**—Salisbury, Md.—The county commissioners have granted a franchise to W. H. Jackson to erect a telephone line from this place to his farm on the Quantico road. A franchise was also granted to Messrs. Samson, Truit, Humphreys and S. E. Gordy to erect a line to connect their farm with the town line.

**STEAM PROPELLERS.**—Washington, D.C.—The following bids were received at the Treasury Department June 26 for the construction of two steam propellers for the U. S. revenue cutter service for the Great Lakes and Eastern Shore: Atlantic Works, Boston, Mass., cutter No. 2, $159,951; time, May 1, 1896; Reeder & Sons, Baltimore, Md., cutter No. 2, $173,764; time, June 25, 1896; Globe Iron Works Co., Cleveland, cutter No. 1, $147,800 and $142,750 for machinery according to bidder's specifications; time, May 1, 1896.

**DREDGING.**—Tacoma, Wash.—A press report of June 28 states as follows: A $6,000,000 dredging contract between the Seattle South Canal & Lake Washington Waterway Co. and the Bowers Dredging Co. was signed yesterday by C. H. Prescott, president of the dredging company and the vice-president of the Northern Pacific R. R. The Seattle company had already signed. Money for the Seattle contract is being furnished by St. Louis capitalists through the Mississippi Valley Trust Co. The contract calls for the excavation of 35,000,000 cu. yds. of earth, of which 9,000,000 yds. are to be dredged from the waterways through the Seattle tide lands and 26,000,000 taken out of the three-mile canal connecting Lake Washington and Puget Sound. The dredging company is a Chicago corporation, having its western headquarters in Tacoma. News reached Tacoma June 27 that the Tacoma Land Co. has raised $1,000,000 on bonds in Philadelphia with which to buy of the state and begin filling in the largest part of the Tacoma tide lands.

## CONTRACT PRICES.

**EXTENDING WATER MAINS.**—Sioux City, Ia.—The contract for extending the water mains to Morning Side has been awarded to E. J. Hanlon, 12-in. pipe to be laid part of the distance and then 10-in., the total bid for 12-in. pipe the entire distance being $16,265. The prices were as follows:

| Items. | Anderson, Linn & Anderson. | Novelty Plumbing & Pipeline Works. | Jas. Scollard & Co. | Hansen Bros. | E. J. Hanlon. | Louis Ketcheron. |
|---|---|---|---|---|---|---|
| 12-in. pipe, 446 tons. | ..... | $33.00 | $34.75 | $32.45 | $33.00 | $35.92 |
| 10-in. " ..... | $40.10 | 34.84 | 36.90 | 32.45 | 33.50 | 38.17 |
| 8-in. " 2.1 tons. | 33.89 | 35.76 | 36.90 | 39.00 | ..... | ..... |
| 4-in. " 1.9 " . | 33.89 | 38.77 | 36.90 | 32.00 | 35.00 | ..... |
| Specials, 30,000 lbs.. | .03 | .03 | .02¼ | .03 | .02¾ | .061 |
| 6-ft. hydrants, 14... | 42.00 | 39.00 | 41.80 | 39.00 | 37.00 | 35.70 |
| 12-in. gate valves, 10 | 40.00 | 36.00 | 27.25 | 23.00 | 35.00 | 47.00 |
| 8-in. " " 1 | 25.00 | 21.00 | 19.90 | 18.00 | 20.00 | 26.10 |
| Valve boxes ..... | ..... | ..... | ..... | ..... | ..... | 6.60 |

**RESERVOIR.**—New Bedford, Mass.—R. C. P. Coggeshall, Supt., writes us that the following bids were received June 26, for the construction of a distributing reservoir, as advertised in Engineering News; Engrs., Geo. S. Rice and Geo. E. Evans, Boston:

Bids Received at New Bedford, Mass., June 26, for Constructing a Reservoir.

| Quantities. | W. P. Latham & Co., Northampton. | McGraw & Malone, Boston. | Clapp & Shipman, New York. | Coon & Mooney, Wilkes Barre, Pa. | Genaro, Long & Little, South Braintree. | G. R. Newman & Co., Providence. | John B. Reilly, Trenton, N.J. | Trumbull & Ryan, Boston. | John Shields, Flemington, N. J. | Jas. S. Paterson, Chicago. |
|---|---|---|---|---|---|---|---|---|---|---|
| *Soil excavated ..... 8,000 cu. yds. | $0.18 | $0.22 | $0.15 | $0.27 | $0.23 | $0.35 | $0.30 | $0.25 | $0.40 | $0.28 |
| **" " ..... 3,000 " " | .18 | .22 | .20 | .45 | .22 | .30 | .25 | .25 | .40 | .25 |
| Sodding ..... 4,600 sq. " | .15 | .35 | .30 | .36 | .20 | .30 | .50 | .32 | .70 | .30 |
| Seeding ..... 6 acres... | 10.00 | 10.00 | 30.00 | 5.00 | 500.00 | 15.00 | 20.00 | 8.00 | 1.00 | 50.00 |
| Earth excavation ....135,000 cu. yds. | .19 | .22 | .23 | .24½ | .26 | .34 | .35 | .30 | .35 | .40 |
| Rock " ..... 100 " " | .50 | 1.50 | 2.00 | 1.50 | 1.50 | .70 | 2.50 | 1.50 | 1.25 | 1.50 |
| Concrete masonry .... 10,500 " " | 4.00 | 4.70 | 4.50 | 4.45 | 4.40 | 4.70 | 4.75 | 5.50 | 6.00 | 6.30 |
| Brick " ..... 75 " " | 10.00 | 12.00 | 12.00 | 12.00 | 15.00 | 12.50 | 9.00 | 14.00 | 9.00 | 10.80 |
| Rble stn. mas.,mortar 7,500 " " | 4.50 | 4.70 | 5.75 | 5.80 | 6.25 | 5.15 | 5.50 | 6.28 | 6.25 | 7.20 |
| Ruble stone mas., dry 300 " " | 3.50 | 4.00 | 3.00 | 4.50 | 3.00 | 3.75 | 4.00 | 4.25 | 5.75 | 5.00 |
| Dimension stone mas. 40 " " | 25.00 | 30.00 | 25.00 | 17.00 | 30.00 | 20.00 | 20.00 | 12.75 | 15.00 | 27.00 |
| Hammered dressing . 900 sq. ft.. | .65 | .60 | .50 | .55 | .50 | .60 | .50 | .60 | 1.00 | .60 |
| Coping ..... 375 cu. yds. | 18.00 | 18.00 | 15.40 | 14.00 | 20.00 | 10.00 | 22.00 | 13.00 | 27.00 | 21.00 |
| Floor pav'g,in mortar 40 sq. " | 2.50 | 3.00 | 2.50 | 2.00 | 2.00 | 2.75 | 2.00 | 4.00 | 3.00 | 4.50 |
| Laying 48-in. pipe... 100 lin. ft.. | 1.25 | 1.25 | 4.00 | 2.00 | 2.00 | 1.65 | 2.00 | 1.50 | 3.00 | 2.25 |
| " 36-in. " ... 110 " " | 1.00 | 1.00 | 3.00 | 1.25 | 2.00 | 1.35 | 1.50 | 1.50 | 2.50 | 1.85 |
| " 8-in. " ... 150 " " | .40 | .25 | 1.00 | .30 | .30 | .35 | .60 | .25 | 2.00 | .25 |
| " 6-in. " ... 550 " " | .40 | .20 | .50 | .20 | .25 | .30 | .50 | .15 | 1.50 | .25 |
| Total ..... | $124,380 | $129,642 | $135,265 | $127,893 | $146,602 | $150,283 | $156,380 | $158,615 | $180,721 | $191,573 |

* Placed in spoil bank. ** Taken from spoil banks and placed on embankment, or slopes, or reservoir grounds.

**BRICK PAVING.**—Gloversville, N. Y.—The following bids were received June 10 for paving portions of two streets, 5,550 sq. yds., with brick; E. B. Baker, Cy. Engr.:

| | Park Paving Co. | S. C. Ferguson. |
|---|---|---|
| Paving, concrete foundation..... | $2.32½ | $2.45 |
| " sand found'n, granite filler.. | 1.82 | .... |
| " " " Port. cement.. | 1.74 | .... |
| Extra concrete ..... | 4.50 | 4.50 |
| Setting and resetting curb..... | .28 | .25 |
| Edging ..... | .65 | .40 |

**BRICK PAVING.**—Adrian, Mich.—James Blair, Cy. Engr., writes us that the contract for paving Church St. with brick was awarded June 24 to Benton F. Graves, of Nashville, Tenn., his bid being as follows: For 3,372 sq. yds. of paving with one course of repressed brick or Canton shale brick, including 2,374 cu. yds. of excavation, 843 cu. yds. of broken stone foundation, 187 cu. yds. of sand, and 1,866 lin. ft. of 4-in. drain tile, at $1.43 per sq. yd.; 1,855 lin. ft. of berea sandstone curbing, 18 x 4 ins., at 30 cts. per lin. ft.; 24 cross-walk gutter plates, weighing 110 lbs. each, at $1.25; 3 street inlets, $5.50 each; total, $5,425. The other bids were as follows:

| | |
|---|---|
| Laidlaw Bros, of Detroit, Mich. | $5 900 |
| Henry Bowen, of Adrian, Mich. | 6.094 |
| Chas. W. M. Kinney, of Toledo, O. | 5.440 |
| Wm. J. McMahan, of Toledo, O. | 5.838 |
| Henry P. Streicher, of Toledo, O. | 5.796 |

**PIG LEAD.**—Buffalo, N. Y.—The following bids were received June 21 for supplying the water department with 100 tons of pig lead for caulking purposes: C. F. Mensch, Buffalo, $6.659; Penn-sylvania Lead Co., Pittsburg, $6.960; Oppenheimer, Hoffeler & Co., Buffalo, $6.539; D. Ullman & Sons, Buffalo, $6.750; Gustavus Benjamin, Buffalo, $6.640.

**CAST IRON PIPE.**—Rochester, N. Y.—A contract for 500 tons of 10 to 4-in. cast iron water pipe has been awarded to the Lake Shore Foundry, Cleveland, O., at $18.90 per gross ton.

**BRICK PAVING.**—Mattoon, Ill.—M. B. Fitch, Cy. Engr., has sent us statements of the paving bids received June 18. The bids for the C St. improvement were rejected, but were as follows:

| Quantities. | T. W. Kinser & Sons, Terre Haute, Ind. | Fries, Barr & Co., Greenfield, Ind. | Davis & Caldwell, Youngstown, O. |
|---|---|---|---|
| Telford pavement, per sq. yd. | $1.30 | $0.88 | $1.05 |
| Berea sandstone curbing, per lin. ft.. | .40 | .42½ | .48 |
| Stratified limestone curb'g," " " | .48 | .47½ | ... |
| Oolitic limestone curbing, " " " | .42 | .44½ | ... |
| Catchbasins, each ..... | 45.00 | 39.00 | 60.00 |
| 10-in. pipe sewer, per lin. ft...350 ft. | .45 | .35 | .38 |
| 12-in. " " " " " ..380 " | .55 | .43 | .45 |
| 15-in. " " " " " ..760 " | .60 | .55 | .48 |
| 18-in. " " " " " ..754 " | .80 | .70 | .55 |
| Manholes, each ..... | 25.00 | 35.00 | 40.00 |
| Lampholes, each ..... | 6.0 | 4.00 | 20.00 |
| Sewer branches, each ..... | 15.00 | 12.00 | ..... |
| Stone crossings, per lin. ft..... | .30 | .80 | .80 |
| Iron bridges spanning gutters, per lb. | .05 | .03¼ | .06 |

Bids Received at Mattoon, Ill., June 18, for Paving East Second St. and Champaign Ave., with Brick.

| Bidder. | Brick per sq. yd.— Clinton P. & B. Co. rep. | Wabash Clay Co. Poston block. | Laot & Morris. | Purington or Galesburg. | Mattoon Tile Co. | Purrington or Anderson & Harr Clay Co. | Alton paving brick. | Decatur or Danville. | —Curbing, per lin. ft.— Berea sandstone. | Stratified limestone. | Oolitic limestone. | Catchbasins, each. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| J. E. Vorhees & Co., Terre Haute, Ind. | $1.53 | $1.71 | $1.60 | $1.74 | ..... | ..... | ..... | ..... | $0.50 | $0.60 | $0.50 | $47.00 |
| Thomas S. Davy, Lincoln, Ill. | ... | ..... | ..... | ..... | $1.65 | ..... | ..... | ..... | .50 | ... | ... | 30.00 |
| Fries, Barr & Co., Greenfield, Ind. | 1.47 | 1.64 | ..... | ..... | ..... | $1.67 | $1.57 | ..... | .45 | .50 | .47 | 39.00 |
| Davis & Caldwell, Youngstown, Ohio. | 1.63 | 1.65 | 1.60 | 1.65 | ..... | ..... | ..... | ..... | .50 | ... | ... | 60.00 |
| Porter, Bowline & Hadley, Tipton, Ind. | 1.78 | 1.99 | 1.90 | 2.03 | ..... | ..... | ..... | ..... | .49 | .53 | .51 | 33.00 |
| A. Mayfield, Lincoln, Ill. | ... | ..... | 1.49 | ..... | ..... | ..... | ..... | ..... | .47 | ... | ... | 33.00 |
| T. W. Kinser & Sons, Terre Haute, Ind. | 1.50 | 1.80 | 1.60 | 1.82 | ..... | ..... | ..... | ..... | .43 | .50 | .45 | 45.00 |
| J. G. Shea, Danville, Ill. (awarded contract).. | ... | ..... | ..... | ..... | ..... | ..... | 1.35 | .45 | .50 | ... | ... | 30.00 |

**CAST IRON PIPE.**—Brooklyn, N. Y.—The following bids were received June 26 for furnishing and delivering 35,740 ft. of 48-in., 5,880 ft. of 36-in., 6,000 ft. of 30-in., and 720 ft. of 20-in. cast iron pipe, and 354,000 lbs. of special castings:

| | Pipe, per 2,240 lbs. | Specials, per lb. |
|---|---|---|
| Chattanooga Foundry & Pipe Works... | $22.90 | $0.02 |
| Howard-Harrison Iron Co. | 21.85 | .0275 |
| R. D. Wood & Co. | 21.30 | .0224 |
| Warren Foundry & Machine Co.; McNeal Pipe & Foundry Co., and Reading Foundry Co. | 20.40 | *.0225 |

* Breeches pipe and short bends, 4½ cts. per lb.

**LAYING WATER PIPE.**—Webster, Mass.—A contract for laying about 8,000 ft. of water pipe has been awarded to F. A. Wellington at 40 cts. per ft. for 12-in. pipe, 35 cts. for 10-in., 28 cts. for 8-in., 25 cts. for 6-in. and 21 cts. for 4-in. pipe. The pipe will be furnished by the Jackson & Woodin Mfg. Co., Berwick, Pa.

**CAST IRON PIPE.**—Minneapolis, Minn.—We are informed that a contract for 100 tons of cast iron pipe, to be used in connection with the construction of the new reservoir, has been awarded to the Michigan Peninsular Car Co., of Detroit, at $19.60 a ton.

**VALVES.**—Allegheny, Pa.—A contract for valves has been awarded to the Rensselaer Valve Mfg. Co., at the following prices: 4-in. valves, $6.20; 6-in., $10.20; 8-in., $15.50; 10-in., $22; 12-in., $28; 15-in., $32; 16-in., $52; 18-in., $56.

**BRIDGE MASONRY.**—Dayton, O.—Local papers state that the following bids were received for the masonry work of Dry Run bridge, West Third St.: John A. Weismantel & Steuer, $3.35 per perch; $3.53 complete (awarded contract); Christian Poock, $3.85 complete; Jacob Gabler & Son, $3.45 per perch, $3.90 complete; Bruno Ritty, $3.99 per perch, $4.50 complete.

**SIDEWALKS.**—Evansville, Ind.—Contracts for building sidewalks until July 1, 1896, have been awarded as follows: For artificial stone, to the Evansville Artificial Stone Co., at $1.80 per sq. yd. 18 cts. for grading and 58 cts. for curbing; for brick, to Boch & Durham, at 34 cts. per sq. yd., 15 cts. for grading, 54 cts. for curbing and $1.25 for corners.

**ASPHALT PAVING.**—Newark, N. J.—Local papers state that the Barber Asphalt Paving Co. has been awarded two contracts for paving with asphalt, aggregating about 53,000, at $2.69 per sq. yd., and the New Jersey Company one contract amounting to about $60,000, at $2.67 per sq. yd.

## METAL MARKET PRICES.

**LEAD.**—New York: 3.25 to 3.3 cts. Chicago: 3.1 to 3.2 cts. St. Louis: 3.1 to 3.12 cts.

**BARB WIRE.**—Pittsburg: $2 for galvanized and $1.30 for plain in carload lots at mill.

**FOUNDRY AND PIG IRON.**—New York: $10.50 to $13. Pittsburg: $10.50 to $13. Chicago: $10.75 to $12.

**TRACK MATERIAL.**—New York: Angle bars, 1.1 to 1.25 cts.; spikes, 1.5 to 1.65 cts.; track bolts, 1.85 to 2 cts. with square, and 2 to 2.1 cts. with hexagon nuts. Chicago: angle bars, 1.45 to 1.55 cts.; spikes, 1.8 to 1.85 cts.; track bolts, 2 to 2.1 cts., with hexagon nuts.

**NAILS.**—Pittsburg: $1.55 per keg for carload lots and $1.65 for less than carload lots, for wire nails at mill; $1.30 and $1.35 for cut nails at mill. Chicago: $1.7 and $1.8 for wire nails, $1.45 and $1.55 for cut nails. New York: $1.7 and $1.8 for wire nails, and $1.45 and $1.6 for cut nails.

**RAILS.**— New York: $24 at eastern mills and $24.75 at tidewater; old rails, $12.50 to $13 for iron, and $10.50 to $11 for steel; steel rails, fit for relaying, $15; light rails, $24; girder rails, $26. Pittsburg: $22 for standard sections of 45 lbs. and over; $23 for light sections; old rails, $12.50 for iron and $10 for steel. Chicago: $25 to $27 for standard sections; $25 for light sections; old rails, $13 to $14 for iron, and $8.50 to $12 for steel.

**STRUCTURAL MATERIAL.**—New York: beams, 1.5 to 1.6 cts.; channels, 1.5 to 1.6 cts.; angles, 1.4 to 1.5 cts.; tees, 1.75 to 1.8 cts.; universal mill plates, 1.65 to 1.75 cts.; steel plates, 1.6 to 1.7 cts. for tank, 1.75 cts. for shell, 1.8 to 1.9 cts. for flange, 2 cts. for ordinary firebox, 2.5 cts. for locomotive firebox. Pittsburg: beams, 1.35 to 1.75 cts.; channels, 1.35 to 1.75 cts.; angles, 1.25 to 1.3 cts.; tees, 1.4 to 1.45 cts.; universal mill plates, 1.35 to 1.4 cts.; steel plates, 1.4 to 1.45 cts. for tank, 1.45 to 1.5 cts. for shell, 1.5 to 1.6 cts. for flange, 2 cts. for ordinary firebox, and 2 to 4 cts. for locomotive firebox. Chicago: beams, 1.6 to 1.75 cts.; channels, 1.6 to 1.75 cts.; angles, 1.6 to 1.7 cts.; tees, 1.65 to 1.7 cts.; universal plates, 1.75 cts.; steel plates, 1.65 to 1.7 cts. for tank, 1.85 to 2.1 cts. for flange, 2.25 to 4.75 cts. for firebox.

## INDUSTRIAL NOTES.

**THACHER & BREYMANN**, of Toledo, O., submarine engineers and contractors, are now laying 8,200 ft. of 60-in. cast iron pipe for the water-works of Erie, Pa.

**THE YOUNGSTOWN BRIDGE CO.**, of Youngstown, O., has the contract for the steel work of a grand stand at the State Fair Grounds, Springfield, Ill. The cost will be about $27,000.

**THE OLIVER IRON & STEEL CO.**, of Pittsburg, Pa., is reported as having increased the wages for puddling to $4.25 per ton, owing to the general improvement in business.

**G. P. EVANS**, 85 Water St., Boston, Mass., will carry on the business of the Evans Friction Cone Co., the copartnership between W. A. Russell and G. F. Evans, doing business under the company name, having been dissolved.

**THE JOHNSON CO.**, of Lorain, O., is reported as having its structural mill working to its full capacity, with large orders on hand, and all branches of the plant are busy. An increase of 15% in wages has just gone into effect.

**THE GOULDS MFG. CO.**, 22 North Canal St., Chicago, Ill., has closed a contract with the city of Oregon, Ill., for an electrical pumping plant to con-

sist of one Goulds triplex power pump, 10 x 12 ins., having a capacity of 500 gallons per minute.

THE CARNEGIE STEEL CO., of Pittsburg, Pa., will double the capacity of its Beaver Falls nail mill by two additions. Part of this plant was destroyed by fire in February. Martsolf Bros. & Co., of New Brighton, Pa., have the contract for the buildings.

THE PHOENIX BRIDGE CO., of Phoenixville, Pa., is at work on material for the Pacific Short Line bridge at Sioux City, Ia., and for an extension of the Brooklyn Elevated R. R. at Brooklyn, N. Y. About 2,000 men are now employed, and an increase in wages has been announced.

THE DETROIT GRAPHITE MFG. CO., of Detroit, Mich., reports that the demand for its superior graphite paint is rapidly increasing among railway and bridge companies. It has recently completed arrangements with Leaycraft & Co., 140 Pearl St., New York city, to acts as its exporting agents for the West Indies and South African trade.

THE LANE BRIDGE CO., of Chicago, Ill., is reported as intending to move its works to Wabash, Ind., and operate there under the name of the Wabash Bridge & Iron Co., which has been incorporated with a capital stock of $60,000. The buildings are to be erected this season. The directors of the new company are P. E. Lane, Chicago, Ill.; John Darst, Toledo, O.; W. H. Roney, Dayton, O.; J. M. Harter, Warren Bunter, John Latchem, J. S. Daugherty, M. S. Howe and Oliver Bogue, Wabash, Ind.

THE WELSBACH COMMERCIAL CO., of New York, N. Y., has been incorporated, with a capital stock of $7,000,000 as a consolidation of the Welsbach Light Co., the United Gas Improvement Co., the American Incandescent Gas Light Co., and the Manhattan Incandescent Gas Light Co. The directors are Henry Seligman, Gen. Samuel Thomas, Calvin S. Brice, Emerson McMillin, Charles B. Van Nostrand and Henry B. Wilson, of New York; Thomas Dolan, Edward C. Lee, Samuel R. Shipley, George Philler, Samuel T. Bodine and Randal Morgan, of Philadelphia.

R. W. HILDRETH & CO., of New York, N. Y., inform us that the mill and shop inspection of the new bridge at Norwalk, Conn., for the New York, New Haven & Hartford R. R. has been placed in their hands. They are also inspecting the material and manufacture of the structural iron and steel for the new Wellington Hotel at 42d St. and Madison Ave., and have been engaged to design and inspect the manufacture of a 700-ft. viaduct for the Port Royal & Western Carolina Ry., to replace an existing wooden trestle at Enoree, S. C.

THE SECKNER CONTRACTING CO., Unity Building, Chicago, Ill., has enlarged the scope of its business by adding to it an engineering department, and has also taken two additional suites of rooms in the Unity Building. Among the contracts it now has on hand are the following: An elevator at Wadena, Ind.; elevator for the Lake Shore & Michigan Southern Ry., at Buffalo, N. Y.; and additional water system at Harlem, Ill. They have also made plans for an elevator to be built at Terre Haute, Ind., and one for a private firm at Columbus, O.

THE PAGE WOVEN WIRE FENCE CO., of Adrian, Mich., reports that the demand for its fence is increasing among the railways, it now being in use on 30 railways. It has recently received orders for several miles from the Lake Shore & Michigan Southern Ry., which road now has over 300 miles in use. It has also recently received the contract for furnishing 18 miles of fence for Litchfield Park, at Tupper Lake, N. Y. It is now seeking to increase the foreign trade, and has recently sent E. G. Fisher, its general agent, to Europe with that object in view.

THE CARSON TRENCH MACHINE CO., of Boston, Mass., states it has sold the following trench machines this season: A Carson-Lidgerwood cableway to F. E. Shaw, of Providence, R. I.; a special Carson-Lidgerwood cableway to Messrs. Stewart & McDermott, of New York city, for use on their New Orleans work. It also reports having leased trench machines to the following contractors and cities: A. F. Allen & Co., Niagara Falls, N. Y.; Brigham & Oates, Brockton, Mass.; Maguire & McKnight, East Orange, N. J.; Morgan, Booth Construction Co., Brockton, Mass.; Weaving, Booth & Co., Belmont, Mass.; Lindsay & Cudmore, Medford, Mass.; Metropolitan Construction Co., Roxbury, Mass.; Metropolitan Sewer Commission, Medford, Mass.; J. D. Creem & Co. (new Carson-Trainor machine), Brooklyn, N. Y.; town of Natick, Mass.; city of Salem, Mass., and city of Boston, Mass. (four machines)

NEW COMPANIES.—Wheeler Mfg. Co., Louisville, Ky.; $25,000; engines, and locomotive appliances; W. Meade Robinson, Robt. H. Wheeler and B. F. Gardner.

Genoa Junction Ice Co., Chicago, Ill.; $2,500; John Lang, William Besleter, Hiram A. Haines.

Winchester Construction Co., Chicago, Ill.; $500,000; Wm. R. Odell, Geo. W. Waterman and William Case.

Southern Dredging Co., Jersey City, N. J.; $25,000, all paid in; George Leary and H. H. Petre, New York.

Atchison Paving Brick Co., Atchison, Kan.; $11,000; Jas. P. McGuire, John H. Barry and Thomas J. Emlen.

Imperial Glass Works, Chicago, Ill.; $50,000; Henry J. Mallernee, Wm. P. McVeity and Thomas F. Champness.

Alton Railway & Illuminating Co., Alton, Ill.; $250,000; Joseph E. Porter, Charles W. Milner, Henry R. Phinney.

American Pump Co., Chicago, Ill.; $45,000; to manufacture pumps; C. C. Hill, H. E. Shrader and R. F. Cummins.

Houlahan Magnetic Separator Co., Chicago, Ill.; $250,000; James Houlahan, Colin J. B. McIver and Jas. E. McDougal.

Wheeling Brick Co., Wheeling, W. Va.; $10,000, with $500 paid in; John E. Clator, Jas. McFaddin and L. J. McCullough.

Chicago Pipe Line Service Co., Chicago, Ill.; $2,000,000; to distribute fluids; John McElligott, Paul Mueller and G. F. Roberts.

James Rees & Sons Co., Pittsburg, Pa.; $300,000, with $30,000 paid in; iron and steel manufacture; Trens., Wm. M. Reese.

Troy Belting & Supply Co., Troy, N. Y.; $50,000; Louis Crandall and A. G. Gray, Troy, N. Y.; G. H. Morrison, Lansingburg, N. Y.

American Electric Fuse Co., Chicago, Ill.; $25,000; to manufacture fuses; Eugene Hildebrand, Clarence F. Brown, Ralph W. Bowman.

Smith-Marder Mfg. Co., Chicago, Ill.; manufacture machines for books; $300,000; Clarence C. Marder, George R. Smyth and Moses Bryant.

Hollow Universal Brakebeam Co., East St. Louis, Ill.; $500,000; brakebeams and railway appliances; James F. Aglar, Fred W. Sultan and Sanford Northrup.

Rockaway & Hudson Co., Jersey City, N. J.; $100,000, all paid in; water-works and general construction; Harry H. Holmes, Thomas Cogan and George Holmes.

Cope Whitehouse Drainage Canal & Reservoir Co.; $5,000,000; construct canal in Egypt; Frederick Cope Whitehouse, C. L. Gammann, Jr., and Henry A. Gardner.

Penn Insulated Wire Co., Camden, N. J.; $150,000, with $75,000 paid in; Franklin S. Randall, 4906 Frankiin St., Philadelphia, Pa.; John Shallcross, 4637 Penn St., Philadelphia, Pa.

Highlands of Navesink Improvement Co., Highlands, Monmouth Co., N. J.; $100,000, with $8,000 paid in; docks, sewers, buildings, roads, etc. Hugh Lamb, East Orange, N. J.; F. A. Dunham, Plainfield, N. J.; Wm. S. Hull, New York, N. Y.

Arkansas City & Northwestern Construction Co., Jersey City, N. J.; $500,000, with $1,000 paid in; electric railways and lighting, and power plants; Marion W. Lewis, Boston, Mass.; John B. Leake, New York, N.Y.; Geo. L. Dayton, Jersey City, N. J.

## IMPROVEMENT IN THE METAL MARKET.

A few weeks ago we noted the advance in the price of steel rails, and this has been followed by a very decided advance in prices for structural ironwork, as will be seen by a list of market prices this week. The prices of pig iron remain about the same, but are steadily maintained, and there appears to be more probability of an advance than of a decline in prices. There has been great activity in structural ironwork, both for bridges and buildings, and numerous large contracts are reported as having been closed. Steel billets have been advanced to $20 and $20.50 at Pittsburg, which is one reason for the advance in prices of rails, but it is said that Eastern mills have not many large orders, the Western mills taking most of the rail business, except in girder rails for street railways, for which many large orders have been placed at $26 per ton. The prices of wire nails were raised at a recent meeting of manufacturers at Pittsburg, the base prices decided on being $1.55 per keg for carload lots and $1.65 per keg for less than carload lots. This is for Pittsburg delivery and means $1.70 to $1.80 at New York. Cut nails have been correspondingly advanced to $1.30 and $1.35, and barb wire is also going up to about $2 for carload lots at the mill. In wrought iron pipe the demand is almost equal to the supply and prices have been advanced. Large sales of malleable iron have been made to manufacturers of agricultural implements, which is considered to be a good indication. Reports from different parts of the country indicate that many works are enlarging their operations and taking on more men, while some works which have been shut down are resuming operation. Advances of 10% in wages at several iron works are also reported. The Illinois Steel Co. recently sent a committee of its men, at its own expense, to visit other large steel works and investigate the rates of wages paid. This committee reported that the wages of men in this company's employ are as high as those paid at any other works, but the company has now announced an advance of 10%, keeping its wages in line with other advances.

LATER.—Another general advance in the price of foundry pig iron was announced July 1 by the Thomas Iron Co., of Philadelphia, which sets the price for the market in the East. No. 1 X is advanced to $13.50; No. 2 X for foundry, $12.50; No. 2 plain to $11.75, and gray forge to $11.50 per ton. The above prices are at the furnace, while to tidewater points the price is 50 cts. per ton more on each grade. The advance averages $1 per ton.


## RESULTS OF A TRIAL.

Sterling, Ill., June 17, 1895.

Engineering News Publishing Co.,

Tribune Building, New York City.

Gentlemen:

I enclose list of bids received June 13 for the West Broadway sewer. In this connection I beg leave to inform you that our city realized this time as never before the benefits of advertising its work in the **Engineering News**. We did not advertise for bids in any paper except the News, and had time for but one insertion in that, and yet I received 112 applications for specifications, and we received 17 bids, while twice that number of bidders were on the ground.

Yours truly,

J. F. Barrett, City Clerk.

## CONTRACT WORK

of all kinds, and in any section of the United States or Canada, should be advertised in Engineering News which is probably read by a greater number of prominent contractors each week than are any other five papers in this country.


## LATE NEWS.

RUTLAND, VT.—Bids are asked until July 13 for constructing 1,200 ft. of 50 to 41-in. brick sewers, 2,400 ft. 30-in. pipe, 1,000 ft. 24-in., 700 ft. 18-in., 700 ft. 12-in., 1,300 ft. 8-in., and 4,200 ft. 6-in. pipe sewers. Sidney Smith, Cy. Engr.

NEWARK, N. J.—Bids are asked until July 11 for rebuilding the woman's division to the Essex county jail. Arch., J. H. Lindsley; C. W. Hellman, Chn. Bd. Freeholders.

PHILADELPHIA, PA.—Bids are asked until July 10 for supplying a gas engine, dynamo and apparatus for the observatory of the central high school. H. W. Halliwell, Secy. Bd. Education.

MAPLE PARK, ILL.—Bids are asked until July 18 for constructing a system of water-works. W. E. Tweadwell, Chn. Com.; J. L. Snow, Village Clk.

CLEVELAND, O.—Bids are asked until July 13 for paving a portion of the Wooster Turnpike with brick. Julius C. Dorn, Clk. County Comrs.

INDIANAPOLIS, IND.—Bids are asked until July 9 for 1,300 lin. ft. of cement sidewalks and 2,845 lin. ft. of brick sidewalks. C. C. Brown, Cy. Engr.

LEWISTOWN, MONT.—Bids are asked until July 15 for repairing the county bridge across Judith River and for constructing a steel bridge of 150 ft. span, according to reports.

CASTINGS, ETC.—Springfield, Mass.—Bids are asked for furnishing steel and iron castings, lumber, and other supplies for the Springfield armory. Col. A. Mordecai, Ordnance Dept., U. S. Army.

## PROPOSAL ADVERTISEMENTS

### JUNE 20.

Engineering News of June 20 contained 112½ ins. of proposal advertisements, every advertisement published having been sent to this office by an official with an order for its insertion in our columns. The work thus advertised was as follows:

| | Bids close. |
|---|---|
| Riprap stone, Tompkinsville, N. Y. | June 22 |
| Furnishing fire-box boilers, Boston, Mass. | June 22 |
| Asphalt or brick paving, W'msport, Pa. | June 25 |
| Constructing 17¾ m. of the T., L.E. & P. Ry. | June 25 |
| Metal work, Round Island L't Station, Mich. | June 26 |
| Erection of Round Island Light Station. | June 26 |
| Furnishing cast iron pipe, Brooklyn, N. Y. | June 26 |
| Furnishing sewer materials, Brunswick, Me. | June 27 |
| Constructing water-works, Monaca, Pa. | June 27 |
| Constructing sewers, Brunswick, Me. | June 27 |
| Boiler and stack, Asbury Park, N. J. | June 28 |
| Stand-pipe and foundations, Maywood, Ill. | June 28 |
| Pumping engine, Asbury Park, N. J. | June 28 |
| Constructing 40 miles of the T., H. & B. Ry. | June 29 |
| Constructing sewers, Grinnell, Ia. | July 1 |
| Furnishing lead pipe, Syracuse, N. Y. | July 1 |
| Constructing sewers, Winnetka, Ill. | July 1 |
| Constructing sewer, Dolgeville, N. Y. | July 1 |
| Constructing water-works, Memphis, Mo. | July 1 |
| Constructing water-works, Elkhorn, Wis. | July 1 |
| Water-works, Rockville Center, N. Y. | July 6 |
| Constructing sewers, East Orange, N. J. | July 8 |
| Macadamizing roads, Richmond County, N.Y. | July 8 |
| Furnishing plate girders, Syracuse, N. Y. | July 8 |
| Steel water tank, Cincinnati, O. | July 9 |
| Water-works, Cornwall-on-Hudson, N. Y. | July 10 |
| Constructing reservoir, New York, N. Y. | July 10 |
| Street lighting, also for erecting an electric light plant, Knoxville, Tenn. | July 11 |
| Brick paving (2 advts.), Waukegan, Ill. | July 15 |
| Plans for art building, Philadelphia, Pa. | Oct. 1 |

### JUNE 27.

| | |
|---|---|
| Stand-pipe and foundations, Maywood, Ill. | June 28 |
| Boiler and stack, Asbury Park, N. J. | June 28 |
| Pumping engine, Asbury Park, N. J. | June 28 |
| Breakwaters, Block Island, R. I. | June 29 |
| Constructing sewers, Grinnell, Ia. | July 1 |
| Constructing sewers, Winchester, Mass. | July 2 |
| Brick paving, Lansing, Mich. | July 6 |
| Water-works, Monmouth, Ill. | July 8 |
| Laying sewer pipe, Bloomfield, N. J. | July 8 |
| Constructing sewers, East Orange, N. J. | July 8 |
| Constructing sewers, Plainfield, N. J. | July 8 |
| Macadamizing roads, Richmond Co., N. Y. | July 8 |
| Steel water tank, Cincinnati, O. | July 9 |
| Water-works, Red Hook, N. Y. | July 9 |
| Constructing reservoir, New York, N. Y. | July 10 |
| Water-works, Cornwall-on-Hudson, N. Y. | July 10 |
| Constructing sewers, Pittsfield, Mass. | July 10 |
| Furnishing sewer materials, Pittsfield, Mass. | July 10 |
| Street lighting, also for erecting an electric light plant, Knoxville, Tenn. | July 11 |
| Brick paving (2 advts.), Waukegan, Ill. | July 15 |
| Macadamizing roads, Morris County, N. J. | July 16 |
| Plans for art building, Philadelphia, Pa. | Oct. 1 |